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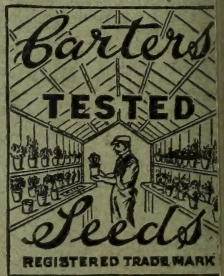

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THE JOURNAL
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THE FEEDING OF FARM STOCK.

CHARLES CROWTHER, M.A., Ph.D.
Leeds University.

PART II.—THE GENERAL FEEDING CHARACTERISTICS OF DIFFERENT CLASSES OF STOCK.

THE outstanding difference in the feeding characteristics of the various classes of stock lies in their relative powers of digesting and utilising the coarse, fibrous foods of the hay and straw type.

Such foodstuffs are dealt with most effectively by the ruminant animals (cattle and sheep), since they are equipped with the necessary powers of mastication and capacious digestive organs. Pigs, on the other hand, cannot deal effectively with any but the softest types of fibre, such as are met with in juicy, green food; whilst horses occupy an intermediate position in this respect. Thus the horse will masticate and digest good hay almost as successfully as cattle, but will be less successful with the harder type of fibre met with in straw.

Young animals, even cattle, are not adapted to deal with fibrous foods until their digestive powers have been well developed by feeding with easily-digested foods, of which the mother's milk is incomparably the best and safest. Even then the introduction of coarse food into a diet must be very gradual and left largely to the natural instinct of the animal. The further feeding characteristics of the various classes of stock may be conveniently discussed separately.

Young Animals.—The growth of the young animal is essentially a rapid production of nitrogenous matters (muscle, &c.)

and bone. Hence the prime consideration in making up the food ration must be to ensure a sufficiently liberal supply of digestible albuminoids (see *Journal,* Feb., 1911, p. 901) and of the bone-forming mineral ingredients (lime and phosphates). Further, it is desirable that any food given with the milk, which will form the basis of the ration during the early months of the young animal's life, shall be, like milk, comparatively rich in albuminoids and oil, and easily digested. No single foodstuff fulfils these requirements more satisfactorily than linseed.

As the animal grows the special requirement for albuminoids decreases steadily in proportion to its total food requirements, and the ration may be correspondingly adjusted to be poorer in albuminoids and richer in carbohydrates. In the case of young stock growing up under natural conditions this adjustment is effected spontaneously. For example, calves or foals running on grass with their dams make the adjustment by steadily increasing the amount of grass eaten in proportion to milk consumed. Where animals are reared under more artificial conditions, the adjustment must be made very gradually. It will always be safer to err on the side of liberality in the supply of albuminoids to growing animals.

The *quantity* of food required by the young animal increases, of course, with the growth of the animal, but not at the same rate. On the contrary, the amount of growth produced per unit weight of food consumed steadily diminishes as growth progresses, until at last the point is reached when the animal attains its full growth, after which no further gain in weight takes place unless fattening conditions are resorted to.

A further matter that demands attention in the feeding of growing animals is the supply of mineral ingredients in the food, and especially of lime and phosphates, since these enter so largely into the composition of the bones. Cases of bone trouble in young stock, especially pigs, have frequently been traced to deficiencies in this respect.

Suitable facilities must be provided for exercise in the open air, in order to ensure full development of the muscles and bones, and general soundness of constitution.

In all matters relating to the treatment of young animals

their welfare and comfort should be objects of special care, all harshness or irregularity being avoided.

To sum up, it is of fundamental importance in the rearing of young stock that all the conditions of feeding, exercise, treatment and environment shall be such as to favour natural development. So far as the food is concerned, this should be liberal in quantity, well supplied with albuminoids, oil and useful mineral matters, of the best quality, and thoroughly suitable in every way.

Many feeders modify the treatment of young stock according to the purpose for which they are subsequently intended, a somewhat heavier and richer ration being given to those that are subsequently to be fattened when full-grown than to those that are to form the future breeding stock. In the former case the qualities desired are size and early maturity, whereas in the latter other qualities are desired which a tendency to fleshiness would in most cases be likely to impair, *e.g.*, the milk-yielding propensities of heifers.

Fattening Young Stock.—The fattening of young animals affords a somewhat different case from the simple rearing of the young animal to maturity. In the former case it is necessary to secure a production of fatty tissue alongside the normal growth of the animal. This is effected by a more liberal feeding and more restricted exercise.

The fattening increase is largely composed of fat, so that the extra food need not be specially rich in albuminoids. In this respect it should be intermediate in character between that supplied for purposes of growth solely and that given for fattening purposes to a full-grown animal of the same class. In other respects the conditions outlined above should be closely observed.

Fattening Adult Animals.—The fattening of full-grown animals is mainly a conversion of food into body-fat, very little albuminoid matter being contained in the fattening increase. The additional food required in excess of the maintenance ration (*i.e.*, the ration required to keep the animals in "store" condition) may therefore consist largely of digestible oil, carbohydrates, and fibre. For reasons already explained (p. 906), however, it is not desirable that the preponderance of carbohydrates, &c., should be greater than is represented

by an albuminoid ratio of 1 : 10. A wider ratio than this can only be justified by the necessity to use up supplies of food-stuffs that have very wide albuminoid ratios (*e.g.*, straw and roots). It will then mean that a greater weight of food must be consumed by the animal in order to get the necessary minimum supply of albuminoids.

If cheap supplies of food rich in albuminoids are available, the albuminoid ratio may be considerably narrowed, but it is not advisable, and rarely practicable, to increase the proportion of albuminoids beyond that which corresponds to an albuminoid ratio of 1 : 4.

Animals that are in poor, lean condition at the outset of fattening should receive a more liberal supply of albuminoids for a few weeks than those which start in fair condition, in order to ensure that the fleshy tissues shall be fully developed and made capable of storing up large quantities of fat.

In deciding what concentrated foods shall be included in the ration, any influence that they are known to exercise upon the quality of the carcass should be kept in mind. Thus, maize, rice-meal, oats, and linseed cake have a softening tendency upon the fat, whilst cotton cakes, peas and beans have the opposite effect.

In order to obtain the best results in fattening, it is necessary that the activities of the animal shall be confined as far as possible to the consumption of food. It is necessary, therefore, to restrict greatly the facilities for exercise. The provision of abundant litter will also contribute to the same end, by inducing the animal to lie down more frequently, as will also all other measures that promote its comfort.

Working Animals.—The requirements of the working animal, so far as the composition of its ration is concerned, are in the main similar to those of the fattening animal, since, under normal conditions, muscular energy is chiefly generated from the carbohydrates and oils of the food, and least of all from the albuminoids. It would thus appear that the ration in the case of full-grown animals may have an albuminoid ratio as wide as 1 : 8 or even 1 : 10. Much depends upon the character of the work to be performed. If great calls are made for a rapid or heavy output of energy, as in the case of racehorses, practical experience shows that it is not advisable to cut down the supply of albuminoids to such an extent as

the above-named ratios imply. Moreover, in such cases the bulk of the food must be given in concentrated, easily digested form, in order that the nutriment contained in it may be quickly placed at the service of the animal, without undue wastage or strain in the processes of digestion.

It must further be borne in mind that the amount of work which an animal can perform is not determined simply by the food-supply. It depends also upon the state of efficiency of the mechanism by which the work is performed (*i.e.*, the muscles). An animal with feebly-developed muscles (*i.e.*, in poor condition) will be unable to perform as much work as when its muscles are fully developed, even although it receive the same ration. The development of the muscles is induced by regular exercise, and requires for its support an increased supply of albuminoids in the food.

For these and other reasons it is advisable that the ration of animals that are called upon for heavy or rapid exertions shall be proportionately somewhat richer in albuminoids than the rations of animals at light or slow work or at rest.

Milk-yielding Animals.—The case of the milk-yielding animal differs essentially from that of the fattening animal or growing animal, in that the special product manufactured by the animal is removed entirely from the body.

From the table on p. 901 it will be seen that the milk of all classes of farm animals contains considerable proportions of albuminoids, fats, and carbohydrates. These materials are manufactured by the animal from ingredients of the body, which must obviously be replaced by feeding if the "condition" of the animal is to be maintained.

The production of milk-fat and milk-sugar can be sustained by supplying oil and carbohydrates in the food, but only albuminoids will serve for the production of the albuminoids of the milk.*

It must further be borne in mind that the milk also contains appreciable quantities of various mineral ingredients, notably phosphates, potash and lime, so that the ration must also make good the removal of these ingredients from the body.

From the foregoing considerations it follows that the milk-

* The question as to how far the functions of albuminoids in the food can be fulfilled by "amides" is still under investigation.

yielding animal requires, in addition to the ration which would "maintain" it were there no secretion of milk, a supply of food which must be greater the more abundant the milk-flow, and which must include a liberal proportion of digestible albuminoids.

The ration of the milk-producing animal may thus be regarded as made up of two portions—a maintenance portion which will vary according to the size of the animal, and a milk-producing portion which will vary according to the milk-yield. Up to a certain point, which varies greatly in different individuals of the same class, any food placed at the disposal of the animal beyond the minimum necessary for maintenance is utilised very economically for purposes of milk-production. When the food-supply is steadily increased, however, the point referred to is reached sooner or later, beyond which there is an increasing tendency for additional food to promote fattening rather than to increase the flow of milk. Eventually the limit is arrived at beyond which no higher yield of milk can be obtained by increasing the food-supply. In these higher stages of milk-production the cost of production steadily increases and must be the determining factor in deciding what is the most profitable yield to aim at.

The percentage composition of the milk yielded by a particular animal is largely independent of the nature of the food supplied. Provided that the ration is such that it maintains the milk-yield and general "condition" of the animal, the composition of the milk can in general be but little affected by changes in the nature of the foods included in the ration. Even in the case of under-feeding, the composition of the milk is, as a rule, but little affected until the condition of the animal has been very seriously reduced. Little reliance can be placed, therefore, upon the claims advanced on behalf of certain foods, that they exercise a specific influence upon the composition of the milk. The commonest of such foods are malt coombs, palm-nut cake, and cocoanut cake—all of which are said to exercise a specific beneficial effect upon the quality of the milk. There is good evidence that this is true *to a limited extent* of the two cakes mentioned.

A further exception ought perhaps to be made of the case of very watery foods, such as turnips or brewers' grains,

in view of the widespread opinion of farmers and cowkeepers that the quality of cow's milk can be appreciably lowered by the use of such foods. This view has received as yet but little support from the experimental investigation of the subject, which, however, needs to be considerably amplified before the question can be regarded as definitely settled. Long-continued consumption of excessively watery food will probably lead ultimately to a general weakening of the organs of the body and thereby cause a secretion of more watery milk. As a rule, however, the amount of water supplied in the food can vary greatly without diluting the milk. Certainly under ordinary conditions the quantity of milk secreted is quite independent of the amount of water consumed by the animal, the excess, if any, being mainly excreted in the urine and through the skin.

Although the nature of the food has, in general, little effect upon the percentage composition of the milk, it may have an appreciable effect upon the quality of the milk in other ways, *e.g.*, flavour, hardness of butter-fat, and so forth. This fact must be kept in mind in selecting foodstuffs for the ration of cows.

The secretion of milk is largely controlled by the nervous system of the animal, and any disturbance of this organisation may have a very marked influence upon the yield and composition of the milk, the magnitude of the effects produced varying greatly in different individuals. Such disturbances may arise from discomfort, harsh treatment, œstrum, or inclement weather.

ROPY MILK.

JOHN GOLDING, F.I.C., F.C.S.

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OF all the abnormal changes which sometimes take place in milk, one of the most common and persistent is what is called "ropy" or "slimy" milk. Such milk, when poured from a jug, has a rope-like form. A spoon or wire dipped into the milk and then taken out draws after it thread-like strands sometimes over a yard in length. Such an abnormal

appearance naturally alarms the consumer, while the persistence of the trouble frequently causes great loss to the milk vendor.

Cause of Ropiness.—The appearance of ropiness in the mixed milk of a herd several hours after milking, is due to the growth of bacteria, which, as a general rule, gain access to the milk after it has left the udder of the cow, though in a few instances they may exist in the udder before milking.

Garget Milk.—Ropiness is sometimes observed in milk from individual cows, notably in cases of inflammation of the udder. In such cases the cause may be either bacterial or non-bacterial. If the ropiness does not increase as the milk is kept and cannot be propagated by transference into another sample of fresh milk, it is probably due to the presence of fibrin and white corpuscles from the blood, which form masses of slimy material in the milk. Such milk is known as garget milk, and it is unfortunate that the term "ropy" should be applied to it, since this use of the word gives rise to the common impression that all ropy milk is unwholesome.

Although garget milk may not cause other milk to become ropy, organisms are present in the milk which may lead to infection being spread from one cow to another by the hands of the milker. For this reason prompt attention should be given to all cows suffering from this disease, and all sources of infection avoided.

An organism (*Bacillus Guillebeau*) which makes milk ropy has also been found in Switzerland in the inflamed udders of cows.

BACTERIA CAUSING ROPINESS.

Classification.—The various organisms producing ropiness are so numerous that it is necessary to devise some form of classification before giving details as to their origin, bacteriological features, means of identification, and methods of eradication.

Probably the most fundamental and easily recognised characteristic which can be used for the purpose of classifying pure cultures of the different organisms depends on the property which some possess of dissolving the casein or curd of the milk, a thick, honey-like solution being produced when the organism is grown for some time in sterilised milk. (See Reference 29.)

To this group, which we may call Group I., belong organisms which, as a rule, require a large amount of oxygen, or, in other

words, are strongly aerobic, growing mostly on the surface of the milk or in the cream layer. None of these organisms produce much acid, and many produce no acid, while others produce an alkaline reaction in the milk.

To another group (Group II.) belong organisms which do not dissolve the casein, but precipitate it by means of the acid they produce. The casein in this state helps to thicken the slimy substance produced, and is not afterwards dissolved. The organisms of this group are able to grow much better without air than the other type. They therefore grow through the entire mass of the milk or whey.

Certain ordinary lactic bacteria sometimes acquire the property of forming slime, and must therefore be included in this group. They are sometimes the cause of sliminess in "starters" used in creameries and cheese factories. In the manufacture of Edam cheese a ropy starter, called "lange wei," is sometimes used in Holland. It is very persistent when introduced into a dairy, and makes cheese of very uniform quality.

Adametz (1) has suggested that the ropy milk organisms may be classified according to the nature of the slime-producing substance. In this method of classification the first and largest group (Group 1) consists of those organisms which produce slimy milk as a result of the swelling of the outside layers of the cell membrane, which, becoming sometimes thicker than the diameter of the organism, makes a sticky capsule, which adheres to solid substances and also causes the organisms to stick together.

A study of the characters given in the unit column of the properties of the organisms (see table in appendix) shows that nearly all the organisms in Group I. come under this head, these being harmless from a dietetic point of view. The ropy cell wall has a composition resembling cellulose, and has in some instances been identified as dextrin.

An exception to the harmless nature of these organisms is *Bacillus Guillebeau* (*c*), which also owes its slime-producing properties to a swollen capsule, but must be classed separately because it comes from diseased udders, and must be regarded as pathogenic or disease-producing.

The members of the second group (Group 2) owe their ropiness to the production of a slimy protein substance, which is also harmless. The chief organism in this group is the whey coccus, which plays an important part in the making of some varieties of Edam cheese.

The third group (Group 3) which Adametz suggests, contains only one known member (*Bacillus viscosus I.*, van Laer). This organism owes its ropiness to a nitrogen-containing substance, which, however, is not a protein.

In some other cases, as with the organisms more generally known as lactic ferments, and in cultures in which ropiness may not always be observed, the cause is more probably due to the enormous number of bacteria developed in the medium than to any specific slimy material produced.

Not Injurious to Health.—With the exception mentioned above, ropy milk caused by bacteria is not injurious to health,

certain kinds of ropy milk being much prized in some countries as an article of diet, but its mechanical condition and appearance are so abnormal that it must be quite an acquired taste. The writer has given ropy whey (made from *Bacillus lebenis*) to pigs, and found they apparently preferred it to ordinary whey.

History of Investigations.—In 1847 Girardin investigated ropy milk from the chemical point of view, and tried to find the cause in the defective composition of the fodder. Lister (2) was, however, the first to infect milk artificially with the disease.

Schmidt-Mülheim was the first to investigate ropy milk from a bacteriological point of view; he published his results in 1883 (3). He found it to be caused by a round organism (*Micrococcus viscosus*), about $\frac{1}{2500}$ of an inch in diameter, which was capable of movement, and occurred frequently in chains. Ropiness is caused by this organism in from 18 to 24 hours.

Since the discovery of this organism many others have been isolated and named (see list in appendix A). They vary very much in size and shape, some being large round forms, others smaller. Large and small rod-shaped organisms may also be the cause of this milk fault.

DISTRIBUTION AND SOURCE OF ROPY MILK ORGANISMS.

These organisms are described in the following paragraphs from the practical point of view, with special reference to their source and distribution.

GROUP I.

Bacillus lactis viscosus, Adametz.

Probably the most important organism from the dairy farmer's point of view is one discovered by Adametz, which seems to be very widely distributed, and has been very fully investigated by him in Vienna, by Ward (4) in America, by Barthel (5) in Stockholm, and was also investigated in 1911 by Mr. Wilfrid Sadler and the writer, who found it to be the cause of a very persistent outbreak of the trouble in Notts.

Adametz first found it present in the Peter's Brook water near Vienna, and also in the effluent from the Liesinger Brewery. In the former case 100 to 200, and in the latter 1,000 of these organisms were present per cubic centimetre.*

Ward states that the minimum temperature for the growth of this organism is 46° F. (8° C.), and the maximum temperature is 104° F. (40° C.). He has come across a case of ropiness caused by this bacillus in milk kept at 45° to 50° F., *i.e.*, at the temperature of cooled milk. Freezing for 24 hours does not destroy the vitality of the organism.

Ropy Cream.—When milk is "set" for 30 to 40 hours after inoculating with *Bacillus lactis viscosus,* the cream only goes ropy.

* These determinations were made by inoculating sterile tubes of milk with attenuations of the water.

TWO PHOTOGRAPHS OF *Bacillus lactis viscosus* ADAMETZ.
(× 1500)

The skim milk is never slimy. Lactic acid bacteria are formed in it which prevent the development of this ropy milk organism.

Ropy cream can be used for butter-making, and only when very ropy has the butter a rather soft and smeary appearance. Butter made from cream even if only slightly ropy decomposes very quickly. In an experiment carried out by Adametz the milk of certain cows was inoculated with this organism, and the cream afterwards made into butter; this butter went rancid in 8 to 10 days, while butter used as control was quite good after three weeks. "When the butter from ropy milk was cut through it showed little holes and looked like soft cheese."

It is thus seen that *B. lactis viscosus,* unlike the acid-producing ropy milk organisms of Group II., does not tend to increase keeping qualities, but, on the contrary, probably favours decomposition.

Ward found the *B. lactis viscosus* in a wooden tank of ice water in which the "40 quart cans" of milk stood every night. The particles of damp sawdust on the floor, which were introduced along with the ice, also brought about a slight viscosity when added to sterile milk. Ward states that dust infected the milk in the creamery.

One dealer discontinued the cooling of the milk, thus giving the ordinary lactic organisms a chance to crowd out the other less common organisms.

C. H. Eckles, of Iowa, who isolated *B. lactis viscosus* from twelve samples of ropy milk and from the air of a stable and a creamery, states:—"The occurrence of ropy milk shows that one condition of good handling has been observed—that of cooling."

Chr. Barthel investigated two cases of ropy milk in Stockholm, and he attributed the cause to *B. lactis viscosus.* In one case the organism was thought to have been in some hay which was used for littering, but this was not proved.

Micrococcus Freudenreichii, Guillebeau.

Freudenreich states that the chief cause of ropy milk in Switzerland is a large, round coccus, with a diameter of $\frac{1}{1250}$ of an inch. It is non-motile, and, unlike *B. lactis viscosus,* liquefies gelatine. In sterilised milk it thrives best at 68° F. This organism grows with such speed and vigour that even unsterilised milk when inoculated with it exhibits a noticeable change in five hours.

Bacterium Hessii, Guillebeau.

Guillebeau isolated an organism from the milk of a cow from a mountain pasture in Switzerland. Although it makes cream slightly stringy it is not probable that it is of practical importance as the sliminess disappears as soon as a little acid is produced.

Straw Coccus.

A coccus which makes milk ropy was discovered by Hohl in samples taken from the interior of bundles of pressed straw which had been sent from the French provinces to Switzerland.

It is interesting as an instance of a possible source of the trouble, but has not at present been proved to be the cause of an outbreak of ropy milk.

GROUP II.

In addition to the pathogenic organism mentioned above are many other types of lactic ferments. *B. lactis aërogenes* has been stated by O. Emmerling to be capable of making milk ropy, although this organism is more generally known as a type of lactic ferment closely resembling *B. coli,* and, like it, is dreaded by the cheese-maker as causing "blown" cheese owing to its power of producing gas.

Other lactic bacteria, as Weigmann (30) has shown, can become slime-producing.

Bacillus lebenis.

The writer has found, for example, that *B. lebenis* grown in whey constantly makes it ropy.

So much acid is produced that this ropy whey will keep for several weeks without undergoing any other changes, although exposed to inoculation by an abundance of other bacteria.

Ordinary whey inoculated with this organism and kept at a suitable temperature in a cheese vat, was afterwards bottled, and though the ropiness decreased in the course of a few weeks, the material was kept for two years without going bad.

Lange wei.

The first experiments with this "starter" were made in the 'fifties by a farmer at Assendelft in Holland, but it was not generally used till 1887, when Boekel strongly recommended its use. Since that time much work has been done on the subject, and Weigmann has isolated a streptococcus from the mixed culture used in practice; but probably this organism is associated with others in the *Lange wei,* which increases its ropy producing properties.

Weigmann has isolated a similar organism from the commercial products known as Taettemaelk (thick milk) of Norway and Filmjölk (stringy milk) of Finland and Sweden, which are prepared as articles of diet. There is a very widespread belief that these beverages are prepared from the leaves of the Common Butterwort (*Pinguicula vulgaris*); but although ropy milk is said to have been produced from the leaves of this plant, Orla-Sopp (31), has shown that this plant does not produce typical Taette. The writer also has not succeeded in attempts to produce ropy milk in experiments with a few plants of Butterwort from Derbyshire, and it is quite probable that the leaves of this plant are not always infested with the organism. These forms of ropy milk are produced by the combined action of several kinds of organisms growing in a mutual relationship which is called "Symbiotic." The milk is not only made ropy, but has also a certain degree of sourness and considerable keeping properties.

Outbreaks of Ropy Milk in the British Isles.—Most of the above organisms have been investigated on the Continent and in America, but there is reason to believe that ropiness is of no less frequent occurrence in the British Isles.

Almost every year for the past sixteen years reports of outbreaks have been sent to the Midland Agricultural and Dairy College. Advice on the lines indicated below has been given, with the result that the trouble has been quickly stopped; but in very few cases has the organism been identified and traced to its source.

During the year 1911 reports reached the writer of outbreaks of ropy milk in the North of England, also in Scotland and in Ireland.

A typical and very persistent outbreak occurred near Nottingham in May and June, 1911, which caused great loss to the farmer whose milk was affected. The case was investigated by Mr. Wilfrid Sadler and the writer.

On June 7th a visit was made to the farm, and the following samples were taken in sterile bottles:—(*a*) The milk from individual cows, and the milk of the herd before and after straining, &c.; (*b*) the water which the cows drank, and the water used for washing the churns, pails, &c.; (*c*) a dilute solution of soda from a wooden tub in which the milk churns and pails were washed, the solution not having been effectively washed out after the cleansing operation; (*d*) the washings of a cloth which was used for drying the churns after scalding; (*e*) rinsings of the milk-pails immediately before use for milking; (*f*) water from ponds in the fields into which the cows were turned—it was found that the cows waded in the ponds, getting the dirty water on their udders; (*g*) the herbage of the fields and the straw in the cow-byre; and (*h*) plates of gelatine were exposed in the fields, cow-byres, &c., and the organisms which subsequenty appeared and which came from the air were examined as to their action on milk.

The discontinuance of the method of cleaning was at once advised. A galvanised iron vessel was substituted for the wooden tub, and this was scalded out after use. It was recommended that the use of a cloth be discontinued. The ponds were fenced round so that the cows could no longer wade in them, and the cows were later changed to another pasture. After these precautions had been taken the trouble quickly ceased.

A bacteriological examination of the samples taken proved that a ropy milk organism was present in large numbers in the

alkaline water in the wooden tub. The cloth used for wiping the churns, and the churns and pails which had been washed in the wooden tub were also infected with this organism.

There is no doubt that the immediate source of infection was the wooden tub, the water in which had probably been made specially favourable for this organism by the use of the dilute soda.

The solution of the problem as to the natural habitat of the organism was indicated by the fact that it was discovered in small numbers in the drinking water standing in a trough under a pump in the field where the cows were turned out when the trouble first arose.

The organism was not found in the other samples of water examined, which included the water from the pump supplying the wooden tub. It would be quite possible for a few organisms to have been carried from this drinking trough to the cow-byre on the udders or on the flanks of the cows, and then to have infected the milk pails. The outbreak was subsequently greatly aggravated by the growth of the organisms in the akaline water of the wooden tub.

The ropy milk organism was not in this case found in the air or in the straw of the cow-byre or on the herbage of the field.

On examining pure cultures of the organism it was found to be identical with that discovered by Adametz, and named by him *B. lactis viscosus*.

The photographs show the appearance of the organism under the microscope (multiplied 1,500 diameters), the slide being made from a young culture on Agar agar.

The other characters all corresponded with the original organism isolated by Adametz, which, as mentioned above, has been found widely distributed in water.

In another case which the writer investigated, the trouble occurred every spring when the cows were turned into a particular pasture, but the source of the organism was not discovered.

SUMMARY.

Causes of Ropiness.—1. Ropiness in the mixed milk of a dairy herd, which increases on allowing the milk to stand, is due to the growth of bacteria.

2. Milk which is ropy at the time of milking may or may not be due to the growth of bacteria; but though it may not cause an outbreak of this trouble, it should not be used for food and should be regarded as more harmful than ropy milk proper.

3. In cases of garget or inflamed udders, special care should be taken against the infection of other cows by the hands of milkers, &c.

4. With the exceptions mentioned in 2 and 3, ropy milk is wholesome and does not endanger public health.

5. The organism may come from water used for washing dairy utensils, &c., or from water in which cows have been standing, or which has otherwise been splashed on their flanks or udders.

6. The trouble may also come from dust and straw, as well as from the *butterwort* and probably other plants.

7. Some forms of ropy milk organisms grow at the temperature of cooled milk.

8. Wooden vessels tend to encourage the persistence of the trouble, as do also dilute solutions of soda if these are not freshly made from boiling water.

9. Most of the organisms require air for their growth, and the cream layer, therefore, tends to go ropy before the lower layers of the milk.

10. Some forms of ropy cream make butter which quickly goes rancid; but on the other hand other organisms are prized as "starters" in the making of Edam cheese.

Tests to be used in cases of Ropiness in Milk.—1. It should first be ascertained whether the outbreak is caused by bacteria by adding a few drops of the affected milk to some sound new milk in a clean glass. This glass should then be placed in a warm room and kept loosely covered to prevent dust getting in. The time taken for ropiness to appear should be noted.

2. The cows should be examined, and samples taken in clean glasses from the milk of individual cows and from the mixed milk after straining, cooling, &c. The time taken in each case for ropiness to appear should be noted.

3. To a glass of clean fresh milk from another source should be added some of the water used for washing the churns and pails and to another glass some of the water

which the cows drink. A glass of this milk should also be left exposed in the dairy.

The results of these experiments may indicate the source of the trouble, but it is as well to adopt the following practical measures :—

Prevention of Ropy Milk.—1. As water is a frequent source of the trouble, special care should be taken in washing the milking pails, strainer cloth, &c., after each milking. When thoroughly clean these should be well scalded and *should not again be rinsed with cold water.* It is well to scald the pails, &c., shortly before milking.

2. Great care should be taken to see that no water is splashed into the milk in the process of cooling, &c.

3. As dust is sometimes a carrier of these germs, the pails, &c., after washing should be kept upside down, and the milk when it is in the pails should be kept covered as much as possible.

4. The rooms where the milk is kept should be well cleaned. Wooden, cement, or stone floors may be cleaned with a mixture of five parts sulphuric acid to ninety-five parts of water, but care should be taken that this does not get on the clothes of the person using it.

5. Wooden vessels should not be used, as they may persistently retain the ropy milk organisms. It is not well even to use wooden troughs for washing milking vessels, but when they are used special care should be taken to clean them on all such occasions.

6. Dilute solutions of washing soda favour the growth of the organism, and it would be better to use sodium hypochlorite or some other cleanser and disinfectant in cases of an outbreak of ropy milk.

7. Straw has been shown to hold ropy milk organisms, and the custom of wiping the udders of the cows with a wisp of straw before milking is very bad. After washing their hands for milking, milkers should not handle straw or fodder, nor should any such material be brought into the cow-byre just before or during milking.

8. The cows should be kept clean and the udders should be washed and disinfected with a very dilute solution of formalin, especially if the cows have been standing in dirty water or wading through mud.

9. Ponds and streams should be fenced off so that the cows cannot wade in them.

10. On the first indication of an outbreak of ropy milk the cows should, if possible, at once be turned into another pasture.

APPENDIX A.

A COMPARISON OF THE PROPERTIES OF THE ROPY MILK ORGANISMS.

In order to compare the principal morphological and physiological features of the chief organisms at present discovered, which give rise to ropy milk, the writer has adopted a modification of the numerical system used by the Society of American Bacteriologists. (28.)

A short description of other striking characteristics of each organism is also given, and in Appendix B will be found references to papers and books on the subject, in which each organism is more fully described.

The organisms are divided into two groups as described on page 992.

Group I.—Group I. consists of those organisms which in pure cultures of milk possess the property of dissolving the casein, making a thick, honey-like solution in old cultures. These organisms tend to produce an alkaline reaction in the milk, though some produce a little acid. They are for the most part aerobic.

Group II.—Group II. consists of those organisms which do not dissolve the casein, but which, by means of the acid they produce, precipitate it. The quantity of acid produced in milk is in some cases very large. They are for the most part facultatively anaerobic.

Group I.

Name of Organism.	Described by.	Reference No.	
Bacillus lactis viscosus	Adametz	(1)	5211·122213
Bacillus viscosus	Adametz	(6)	6211·111267
Micrococcus Freudenreichii ...	Guillebeau	(7)	1221·111211
Bacterium Hessii	Guillebeau	(8)	6216·111040
Carphococcus pituitoparus ...	Hohl	(9)	2220·122013
Diplococcus viscosus	Y. Sato	(26)	2221·121214
Coccus lactis viscosi	Grubler	(10)	2200·111015
Bacillus viscosus I.	van Laer	(11)	6203·122315
Actinobacter du lait visqueux ...	E. Duclaux	(12)	6221·0001
Actinobacter polymorphus ...	E. Duclaux	(13)	6001·0001
Potato bacillus	F. Heuppe	(14)	1·
Bacillus mesentericus vulgatus ...	Flügge	(15)	5111·216215
Bacterium visco-fucatum	F. C. Harrison and B. Barlow	(27)	5221·114255

Group II.

Micrococcus viscosus	Schmidt-Mülheim	(3)	3012·000005
Micrococcus mucilaginosus ...	S. v. Ratz	(17)	8201·111026
Micrococcus viscosus lactis ...	Conn	(18)	3000·101000
Bacterium Guntheri	R. Burri	(19)	6220·221200
Bacillus lactis pituitosi	Loeffler	(20)	7121·225007
Bacillus Guillebeau (*c*)	E. von Freudenreich	(21)	5001·021148
Bacterium lactis aërogenes ...	Emmerling	(22)	5221·0211
Bacillus lebenis		(23)	
Streptococcus hollandicus	H. Weigmann	(24)	3002·020003
Streptococcus lacticus	H. Weigmann	(25)	

The characters which have been selected for comparison are indicated by group numbers as follows :—

Numerical System Selected for Comparing the Characters of Ropy Milk Organisms.

Group Number.	
1000	Large coccus about 2μ in diameter.
2000	Small ,, ,, 1μ ,,
3000	Streptococcus.
5000	Short rod
6000	Long ,, 1$\mu \times 2\mu$.
7000	Slightly curved rod.
8000	Oval cocci 1·2$\mu \times$ 2·1μ.
100	Endospores produced.
200	,, not produced.
10	Motile.
20	Non-motile.
1	Ropiness due to swollen capsule.
2	,, ,, slimy protein substance.
3	,, ,, non-protein nitrogenous body.
4	,, ,, enormous number of organisms.
6	No capsule produced.
0·1	Aerobic.
0·2	Facultatively anaerobic.
0·01	Gelatine liquefied.
0·02	,, not liquefied.
0·001	,, colonies white and shining.
0·002	,, ,, small and opalescent to transmitted light.
0·004	Produces a wide range of colours—blue, &c.
0·005	White colonies, brownish to transmitted light.
0·006	Liquefying colonies, like hay bacillus.
0·0001	Gas produced in milk.
0·0002	No gas produced in milk.
0·0003	Produces a yellowish-green curd on surface of milk.
0·00001	Ropiness strong and permanent in milk.
0·00002	,, weak, but ,, ,,
0·00004	,, weak; passes off in time.
0·00005	,, permanent grey or green-blue produced in forty hours.
0·00006	All casein dissolved; liquid, yellow, and slimy.
0·000001	Makes milk ropy at room temperature under 5 hours.
0·000003	,, ,, ,, ,, ,, ,, 15 ,,
0·000004	,, ,, ,, ,, ,, ,, 20 ,,
0·000005	,, ,, ,, ,, ,, ,, 25 ,,
0·000006	,, ,, ,, ,, ,, ,, 36 ,,
0·000007	,, ,, ,, ,, moderately rapidly (2 days).
0·000008	,, ,, ,, ,, slowly.

Example of Method of Using the Numerical System.

Bacillus lactis viscosus, Adametz, 5211·122213.

5000	The organism is a short rod.
200	Endospores are not produced.
10	It is motile.
1	Ropiness is due to a swollen capsule.
0·1	The organism is aerobic.
0·02	Gelatine is not liquefied.
0·002	Colonies on gelatine are small and opalescent to transmitted light.
0·0002	No gas is produced in milk.*
0·00001	Ropiness is strong and permanent in milk.
0·000003	Milk is made ropy in less than 15 hours at room temperature.

* Adametz states that a little gas is produced, and that bubbles were seen on shaking a tube culture in milk. There is, however, no evidence of gas being produced in Durham tubes.

Additional Characters.—In milk the capsule is very marked, and is sometimes as thick as the length of the organism; but in most cases is only one-third the thickness of the rod.

Ward has noted a great difference in the size of individual organisms when grown in bouillon culture, and also that in this case the two ends of the rods are more darkly stained (bipolar staining).

The bacilli are readily stained by aniline dyes, also by Gram's stain and by hæmotoxylin.

The method of Gabbi (26) and Welche's glacial acetic acid method are recommended for the staining of the capsule.

Large involution forms are frequently observed in old cultures; they often resemble yeasts in size and shape.

COMPARISON OF THE CHARACTERS OF VARIOUS ROPY MILK ORGANISMS.

It will be seen on looking up the thousands column that ropy milk organisms differ very much in size and shape.

There is, however, a considerable tendency to variation between individual organisms of the same kind, this being very marked in bouillon cultures. Many of the organisms produce involution forms, so that very fresh cultures should always be prepared before making slides for the purpose of identification.

The tendency to form chains and the length of the rods are very variable.

From the hundreds column it will be seen that spore formation is as a rule absent. Special care must be taken in examining *Bacillus viscosus,* which, according to Conn, gives the appearance of spores with double staining.

Although different members of the group vary greatly as regards motility (see ten's column), the character is not a very reliable one for the purpose of identification. If, however, fresh cultures on agar are made daily for a week and kept at an optimum temperature motility should be observed in the seventh culture, if the organism possesses the property. The culture should be examined when 8 to 16 hours' old.

The cause of ropiness (see unit column) is a fundamental difference, which, as mentioned above, can be used for purposes of classification, but it does not serve to distinguish between the many organisms which owe their ropiness to a swollen capsule.

It is evident from the first decimal place that most of these organisms are more or less aerobic; the organisms in Group I., being "obligate aerobes," with one or two exceptions.

The liquefaction of gelatine (second place of decimals) is a valuable property for the purposes of identification, but in some cases the liquefaction takes place very slowly; *Micrococcus mucilaginōsus* only liquefies gelatine in three weeks.

The variation in this respect between the individual members of Group I. indicates very fundamental differences in the chemical action of these organisms on the nitrogenous constituents of milk, and work in this direction would probably bring into greater prominence the differences between the organisms of this group.

The numerical system fails to do justice to the method of distin-

guishing between members of this group by the appearance of colonies on gelatine (third place of decimals). Descriptions of the growth on various media are given in most of the original papers, and in some of the text-books mentioned, and, better still, pure cultures of many of the organisms can be obtained for comparison in this respect.

As regards gas production (fourth place of decimals) the strongly aerobic nature of the organisms of Group I. makes it difficult to obtain growth in a closed tube, but in some cases considerable quantities of gas are produced.

The permanence of ropiness (fifth place of decimals) must necessarily be studied in pure cultures. If other organisms are present variable results may be obtained.

The time taken to make milk ropy (sixth place of decimals) is a factor of the greatest importance from a practical point of view. The writer has excluded all those organisms from the list which take longer than three days to produce this condition, as these would be of no practical importance to the milk vendor.

The staining quality of these organisms does not offer a good means of differentiation, as they all stain fairly well by ordinary methods.

APPENDIX B.

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THE PRODUCTION OF BEET SUGAR IN A CONTINENTAL FACTORY.

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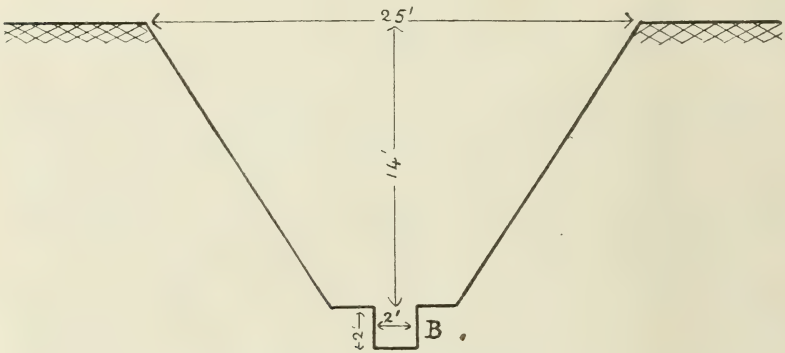
A factory generally starts its "campaign" or season, as soon as the beets are ripe enough. This is often as early as the middle of September on the Continent; and to induce farmers to send their roots earlier or later than the majority, it is not unusual for a factory to offer a rather higher price, as it is very necessary that the supply should be regulated. This question is only vital where very sharp frosts are experienced before Christmas. Badly frosted beets can be worked up if taken before the thaw sets in, but after this they become "woolly" and soft, through the bursting of the cells, and are then liable to give trouble in the factory.

Delivery, Weighing and Sampling of Roots.—The delivery of the "roots" takes place by road, rail, or water. The wagons or railway trucks are weighed over a weighbridge both before and after unloading, and it is the usual custom for sample quantities of about one to two bushels to be taken from the wagons of each farmer for a few days at the beginning and at intervals during the "campaign." These are weighed, washed and reweighed, in order to ascertain the amount of "tare" to be deducted, which usually amounts to from 10 to 20 per cent. Sample roots are also analysed for their sugar content by means of the polarimeter.

Disposal of Roots at the Factory.—The wagons are drawn up alongside the "flumes" or open channels and unloaded mechanically by means of hydraulic levers under the railway trucks, or by handforks. The latter is much the more common method.

The "yard" of a modern factory is divided up into long parallel channels or pits, which are about 100 ft. (more or less) in length, 20 ft. to 30 ft. wide and 4 ft. to 15 ft. in depth. The pit is built of brick or concrete with a "flushed" surface, and its sides slope, so that at the bottom it is only a few feet across. An open channel (see *B*) runs down the middle, having a width and depth of about 2 ft. Iron plates are laid across the top of the gutter *B*, except where the beets are allowed to fall into it. Water rushes along this gutter and thus floats them towards the factory.



CHANNEL ALONG WHICH BEETS ARE FLOATED TOWARDS THE FACTORY.

In this way hundreds of tons of "roots" can be unloaded into this pit continuously. It is also possible to regulate the quantity falling into the gutter.

Washing.—As a rule the beets have to be lifted to a higher level before entering the washing machine. This lifting is done by means of a scoop wheel or chain elevators, revolving screw "worms" or by the more modern "mammoth" pumps. The "mammoth" pump consists of a U-shaped iron cylinder, having one arm longer than the other. The beets flow into the shorter arm with water, both being gradually raised into a spout and thence into the washing machine by means of the compressed air in the long arm of the U tube, which is provided from a compressor.

The horizontal beet-washers are fitted with a revolving shaft having iron arms, which keep the mass constantly on the move towards the elevator at one end. The trough is fitted with stone catchers.

Weighing.—The beets are next raised by a bucket or chain elevator to the top of the factory and discharged into an automatic weighing machine holding about 800 lb. This machine records accurately the washed weight of all the beets passing through the factory, and in this way a check is obtained both on the outside weighings and on the sugar yield.

Slicing.—As soon as the known weight of beets is reached, the basket tilts automatically and its contents are delivered by gravitation into hoppers, and thence into rapidly revolving cutting or slicing machines. These machines have horizontal plates or discs fitted with sharp fluted blades or knives, which revolve at a great rate and cut the beet into slices known as "*Schnitzel.*" The knives have constantly to be removed for sharpening.

The slices are regular in shape, being about 3 to 4 inches long by one-eighth of an inch in diameter.

The Extraction of the Sugar by the Diffusion Process.—After leaving the "slicer" these slices are conveyed to the diffusers by means of a travelling rake conveyor and shoots (see Fig. 1). The diffusion battery consists of a number of iron cylindrical cells or diffusers, which may hold as much as five or more tons of slices, and are fitted with valves to regulate the supply of hot juice and water, and also with a movable cap top and bases for filling and emptying.

The hot juice and water is forced by pressure through the diffusers and the process of extracting the sugar by diffusion is set up. The hot juice is run from one diffuser to another and after going the whole round of the battery it is drawn off and conveyed into centripetal cylindrical strainers, after which it is measured automatically, heated in pre-heaters and forced into the lime mixers to be mixed with quicklime which has been prepared from the kiln outside, whereby it is purified or defecated.

Purification of the Juice.—A chemical reaction and a mechanical action take place, the lime helping to precipitate

and decompose the non-sugars, and to carry suspended organic bodies down with it. This defecation may take place in a separate vessel or in the carbonatation tank.

Carbonatation is brought about by driving carbon dioxide into the defecated or purified raw juice by means of pumps. This causes the formation of calcium carbonate, etc., which form a precipitate. After this first carbonatation, or saturation of the juice with CO_2, it is pumped up to the filter presses which separate the suspended precipitate and the partly purified juice. This treatment is repeated in a second carbonatation tank and filter press and sometimes a third, where the alkalinity of the juice is finally adjusted.

The residual lime-cake is conveyed by means of transporters to a heap outside and eventually is given to the farmers or sold for about 2*s*. to 3*s*. a ton. It contains:

0·46	per cent.	Potash (K_2O).
1·28	,,	Phosphoric acid (P_2O_5).
1·22	,,	Magnesia.
9·25	,,	Calcium carbonate.
21·23	,,	Organic matter (fine beet rootlets, &c.).
50·00	,,	Water.
16·56	,,	Other constituents.
100·00		

The purified thin juice passes on to the evaporators (see Fig. 2) in order to evaporate some of the water (about 80 per cent. of juice weight) and convert the thin juice from about 13° Brix., into a thick juice having a density of about 60° Brix. In order to effect this operation economically, the evaporation system is based on the principle that the latent heat is used over and over again, in modern factories generally four or five times. The evaporating pans are arranged in series, and the first vessel is heated either by direct steam, exhaust steam, or high pressure vapour from a juice preboiler; the exhaust steam or vapour is condensed after parting with its heat to the juice or liquor in the first vessel.

The vapour which is given off from the juice thus heated, now passes into the heating chamber of the second vessel, where it in its turn is condensed and gives off its heat to the juice in this vessel. The same process is repeated in the third and fourth vessels.

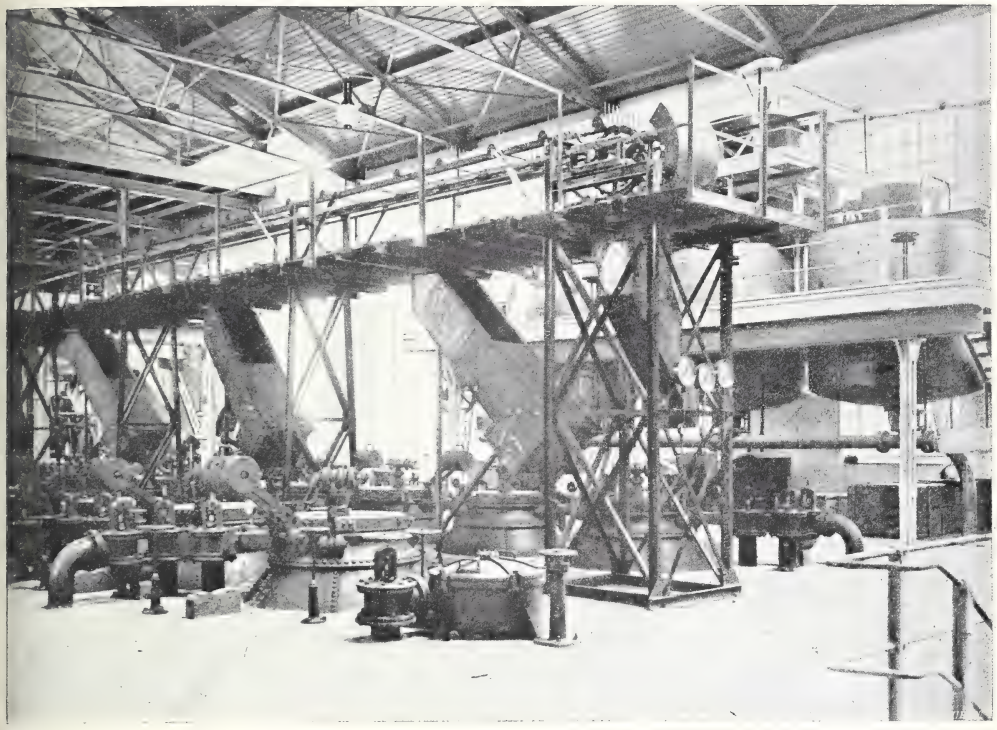


FIG. 1.—SLICE CONVEYOR AND DIFFUSION BATTERY.

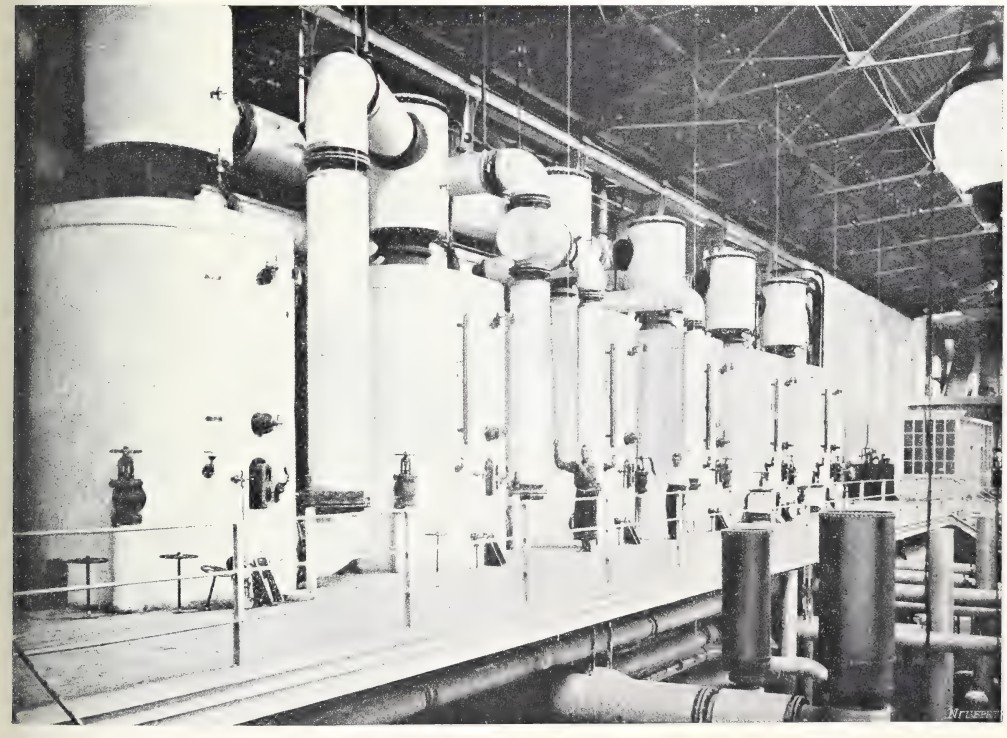


FIG. 2.—EVAPORATING PLANT.

The vapour from the fourth vessel now passes, as a rule, through juice heaters where as much as possible of its remaining heat is utilised. It then passes on to the condenser. This vapour is at a very low tension. In order to maintain a vacuum in the condenser, it has to be provided with an air-pump to draw off all incondensible gases, which are always more or less mixed with the vapour, and which would otherwise accumulate in the condenser. It will be seen that 1 lb. weight of steam (as measured in a closed vessel) evaporates nearly its own weight in each of these vessels, *i.e.*, it has almost a fourfold economy.

The thick juice from the evaporators is pumped to another carbonatation or sulphitating installation and after treatment is again filtered and passed on to the vacuum-pan supply tank and thence to the vacuum pans (see Fig. 3).

This final evaporation of the concentrated juice in the vacuum pans is also performed in a comparatively high vacuum, in order that the sugar may boil at a very low temperature, and thus not subject the crystals to caramelisation or "burning." The vapour issuing from the vacuum pans is also condensed in a condenser provided with an air-pump.

In most modern factories there is only one condenser in the whole factory, which serves for both the evaporators and vacuum pans. This thick juice in the vacuum pans is boiled until it reaches a condition known as "massecuite," *i.e.*, a mixture of well defined crystals and concentrated syrup. This "massecuite" is now discharged into crystallisers where it is cooled down by stirring, thus allowing the "grain" to grow, and it is afterwards passed to the centrifugals, which by the rapid revolving action separate the crystals from the adhering syrup, the latter passing through the finely perforated periphery, leaving the crystals of sugar adhering to the sides of the centrifugal basket.

This first sugar has a polarisation of about 96 per cent. to 97 per cent. The syrup is again treated by boiling, etc., as before, and after passing through a second lot of centrifugals yields a sugar having a polarisation of about 90 per cent. The

resulting syrup forms the by-product called "molasses" or agricultural treacle.

Waste-waters or "Effluent."—The waste water that is pressed out from the used pulp and also that from the diffusion battery is liable to cause trouble by giving off noxious gases produced by the fermentation of the organic matter. To avoid this the water is usually treated with lime and an iron salt, and then allowed to run out into a series of "settling ponds," together with the water from the "washer," etc. After being allowed to remain for about 3 days in one pond or basin, the water is run into a second and so on until a fairly pure liquid is obtained. It is sometimes then run across a meadow and into a stream.

The "Steffen" Process.—Factories fitted with this patent process differ from the ordinary ones in having the diffusion battery replaced by a trough fitted with a revolving screw, by means of which the slices are slowly moved through the trough while in contact with hot water or hot raw juice. This is known as "hot infusion." Not so much sugar is extracted, but the advantages claimed are :—

(1) That the initial outlay is less.

(2) That the resultant dry slices contain 30 per cent. to 35 per cent. of sugar instead of 5 per cent. to 6 per cent. in the ordinary slices, and therefore a higher price can be charged the farmer per ton.

(3) That the working expenses are less, because it is the last portion of the sugar that is the most difficult to obtain and crystallise.

It is sometimes worked in conjunction with the diffusion battery, and the manufacturers informed the writer that the extra cost was about £7,500 for a 600 ton factory. In this way it is claimed that almost the whole of the sugar can be extracted. If sugar is cheap, the "Steffen" process can be used alone. Very few factories seem to be fitted with this process, however, and it does not seem to be popular at present. A well-known authority in Germany informed the writer that the price asked for the "Steffen slices" was too high in proportion to their actual feeding value, and that in practice the extra sugar did not give such good results as might be expected

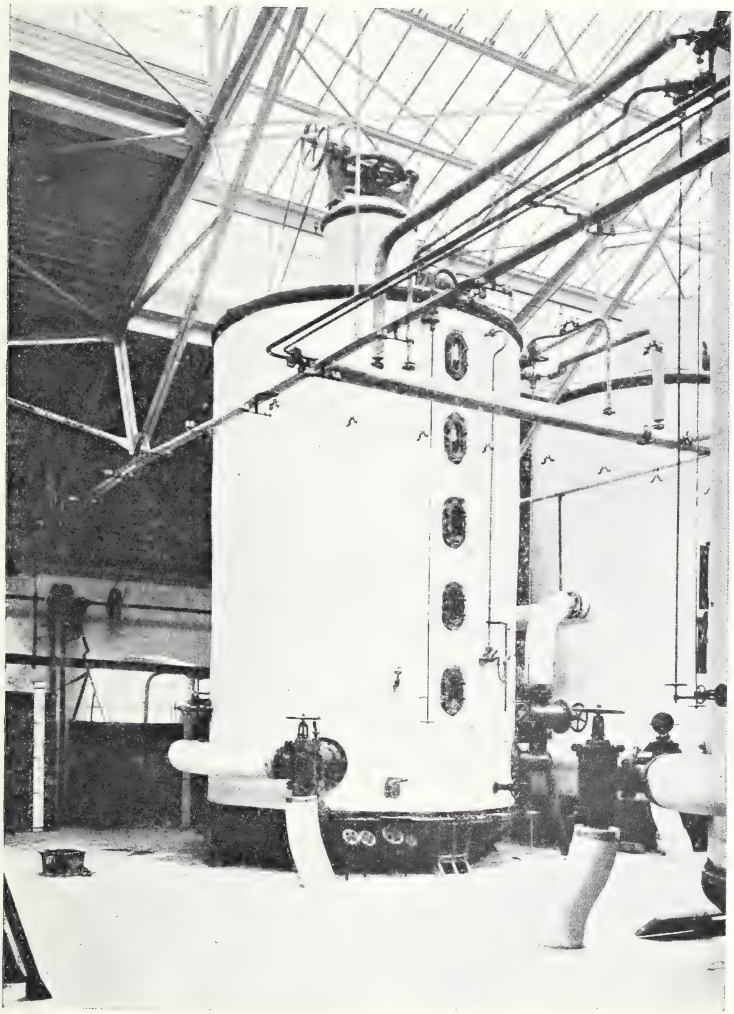


FIG. 3.—"AFTER PRODUCT" VACUUM PAN.

because of the digestible nature of the carbohydrates present in the ordinary slices, which only contain about 5 per cent. to 6 per cent. of sugar.

Heat in Factories.—The old buildings are often "cramped" for room and are badly ventilated. In such cases the atmosphere is hot and oppressive. A modern factory, however, is like one big hall, excellently ventilated and by no means objectionable, and the so-called "obnoxious odour" is a fallacy. The writer stayed at different factories and did not experience any such unpleasantness.

The following data relate to a German factory dealing with 1,200 tons of beet in the 24 hours (unless otherwise stated), and were given to the writer by the manager.

Water.—The purer the supply the better it is. Soft water is preferable to hard, but it is not a *sine qua non*. The quantity required for floating the beets in and washing is about 1,100 gallons per minute. For the diffusion battery, 250 per cent. of the weight of roots is wanted if entirely fresh water is used. If part of the water is purified and used over again, it is possible to do with 120 per cent.

In another factory in Bohemia of 1,000 tons capacity, 1,500 gallons of water per minute (about 7 cubic metres) were required, which is equivalent to 9,640 tons of water every 24 hours.

Coal.—Brown coal is generally used on the Continent. About 6 per cent. of beet weight would be required when using English coal of fairly good quality. Thus for a 1,000 ton factory, about 60 tons of coal would be required every 24 hours.

Limestone.—About 4 per cent. of the beet weight is required. Therefore 40 tons would be used every 24 hours in a 1,000 ton factory.

Number of "Hands."—In this 1,200 ton factory, 270 men are at work during the factory season, but only about 80 in the summer. The remainder work on the land or at other industries, such as brickmaking, when not required in the factory.

Wages.—Staff in the factory; Manager, £500 to £750 per annum; 2 Chemists, £100 to £150 per annum; 1 Engineer, £125 to £150 per annum; 1 Assistant, £125 to £150 per

annum; 2 Book-keepers—1st, £200 to £250 per annum; 2nd, £125 to £150 per annum.

In addition to the salary the manager generally has a house, and the staff have free lodgings, light and heat.

Unskilled Labour.—The men get 4*s.* to 5*s.* a day.

Beetroots.—The cost to the factory of one ton delivered and everything included varies from about £1 to 25*s.* Cost of working same per ton is about 6*s.*

Beet-Sugar Factory at Dinteloord, Holland.*—This new factory is most interesting not only with regard to its modern building and machinery, but also to the fact that it is a co-operative concern and entirely run by farmers.

WORKING ACCOUNT OF THE SEASON, 1910–11.

Received:—

	£
Net proceeds, sugar	140,921
,, pulp	8,185
,, molasses	3,983
Sugar beets lost and covered by insurance and proceeds of beet sold	127
Balance on shares and direct receipts	110
Total	£153,326

Less Costs of Working:—

	£	£
Depreciation	6,036	
Maintenance	4,285	
Factory materials	5,473	
Wages	3,289	
Salaries and allowances	1,249	
General expenses	1,349	
Interest	509	
Cost of receiving beets, freights, wages, controller's account	10,438	
		32,628
Balance of working account		120,698
Fines received		11
Total		£120,709

Less Charges under Art. 21 of Association:—

	£	£
Interest	3,700	
Redemptions	4,000	
Dividends 4 per cent. on capital paid up	1,050	
Fire insurance	182	
		8,932
		£111,777
Paid to members supplying sugar beet		111,461
		£316
Still to be paid		316

* Some additional particulars with regard to the factory are given in the article on pp. 1014–1017.

ASSETS.	£	£	£
Engines		64,907	
Depreciation last year	2,772		
,, this ,, ...	2,802	5,574	
			59,333
Buildings		41,599	
Depreciation last year	1,248		
,, this ,, ...	1,248	2,496	
			39,103
Lands around the factory		10,305	
Depreciation last year	134		
,, this ,, ...	2,558	2,692	
			7,613
Electric installation		3,753	
Depreciation last year	178		
,, this ,, ...	175	353	
			3,400
Laboratory		571	
Depreciation last year	20		
,, this ,, ...	20	40	
			531
Office furniture		242	
Depreciation last year	4		
,, this ,, ...	7	11	
			231
Quay		1,638	
Depreciation last year	57		
,, this ,, ...	57	114	
			1,524
Vessels		612	
Depreciation last year	24		
,, this ,, ...	24	48	
			564
Railway		2,757	
Depreciation last year	111		
,, this ,, ...	111	222	
			2,535
Implements		3,694	
Depreciation last year	211		
,, this ,, ...	208	419	3,275
Bags			22
Cloths			166
Chalk			333
Cakes			91
Coal			750
Molasses			3,750
Sugar beet seed			1,570
Stores			1,302
Timber			50
Debtors			15
Buyers of sugar			73
Shareholders			49
Cash			59
Bankers			10,753
Premium of Insurance paid in advance			727
Balance on shares still to be received			1

LIABILITIES.	£	£
Subscribed Capital	111,167	
Less to be paid up in case of need	83,375	
		27,792
First mortgage 5 per cent. obligations	75,000	
,, 5 ,, redeemed	3,580	
		71,420
Second mortgage 5 per cent. obligations	25,000	
,, 5 ,, redeemed	415	
		24,585
Creditors		2,574
Deposits		9,617
Interest on obligations during three months		1,200
Costs		280
Balance still to be paid under Art. 26 of the regulations...		317
Sugar carriage, insurance		33
Coupons of Loan due and unpaid		2

Some 700 farmers are shareholders, and 3,430 shares of £36 each have been taken up. Of these farmers about 300 are "small-holders" and have taken one share each, one fourth being paid in cash and the balance in roots. A large sum was borrowed, but this must be cleared off in 25 years.

A shareholder contracts to provide the factory with a minimum of 15 tons and a maximum of 35 tons of roots per share. About 119,000 tons of beet were worked up during the past season. The total in 1910–11 was 87,000 tons. In 1910 the average sugar percentage was 17·54, the highest 20·4, and the lowest 15·8 per cent., and the factory was able to pay as much as 25*s*. per ton including profits, after making extensive allowance for depreciation, paying 4 per cent. on capital, and redeeming £4,000 of the mortgage.

A copy of the working account and balance sheet for the year ending March, 1911, is given on the previous pages.

A CO-OPERATIVE SUGAR FACTORY IN HOLLAND.

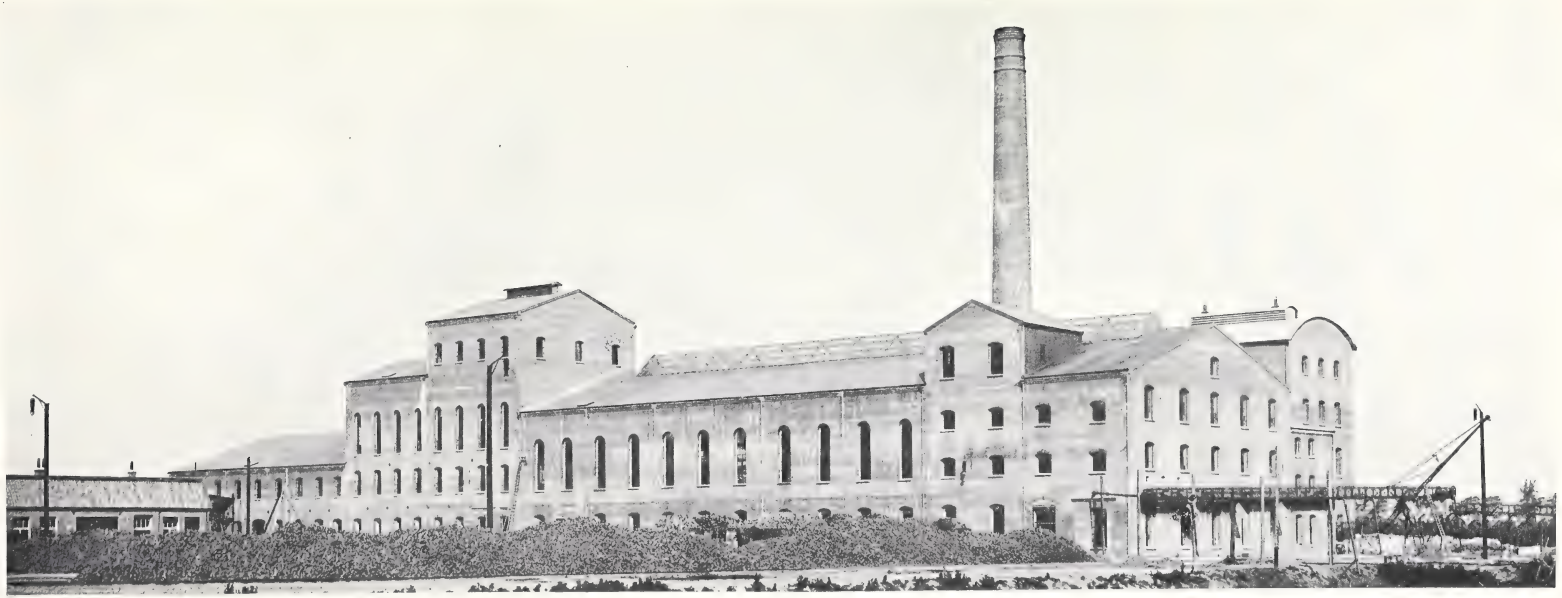
"Home Counties."

Author of "Sugar Beet: Some Facts and Some Illusions."

The first co-operative sugar factory which was established in Holland is in Zeeland, at Sas van Gent. In 1909–10 it worked up 47,600 tons of beets and in 1910–11 some 53,000 tons. It paid 23*s*. 1*d*. per ton in the former campaign and 24*s*. 2*d*. in 1910–11. The sugar percentage in the one campaign was 16·27 and in the other 17·16. The beets handled daily averaged 780 tons in 1909, and 800 tons in 1910. The factory's capital consists of 900 shares, of about £33 each, on which about £8 is paid. They are practically all held by farmers. The minimum quantity of beets that may be sent in per share is 15 tons, and the maximum 30 tons.

The most modern co-operative factory in Holland is situated at Dinteloord. The order for this factory was given to the contractors on January 9th, 1909; building began in February, and the factory was making sugar on October 13th in the same year.

The figures in the table on the next page show the results



The Co-operative Beet Sugar Factory at Dinteloord, Holland.

of its working in the three seasons during which it has been in operation.

	1909–10.	1910–11.	1911–12.
Beet handled in season	65,000 tons	87,000 tons	119,000 tons
,, daily ...	1,038 ,,	1,333 ,,	1,400 ,,
Price	21*s.* 8*d.* per ton	25*s.* 1*d.* per ton	28*s.* 4*d.* per ton
Members	644	704	720
Shares...	3,150	3,368	3,430

Some three hundred of the members have only a single share each. In 1909–10 the quantity of beets received per share was 21 tons, in 1910–11, 26 tons, and in 1911–12, 34 tons, the maximum allowed being 35 tons.

On the original 3,000 shares the farmers paid £8 4*s.* per share, making a total of £25,000. Four per cent. must be paid on this. The cost of the factory was £135,000. The balance was found by means of "shares, mortgages, bankers and members."

The farmers are justifiably proud of their up-to-date factory. Its manager is the son of the late manager of the biggest sugar factory in the country, the premises of which adjoin the co-operative enterprise at Dinteloord. The factory is to be enlarged, at a cost of from £10,000 to £14,000, to a total capacity of 1,700 tons daily, and may therefore become the biggest sugar factory in Holland.

I found about 3,000 tons of beet piled up outside the factory, the stacks reaching as high as the houses that had been built for the accommodation of the director, chemist, accountant, and engineer, for in a "campaign" which goes on day and night all responsible persons must be on the spot. One of the three electric cranes is alone capable of transferring 400 tons of beets in a day from the barges to the concrete slopes of the storing place. There were convenient facilities for weighing both the railway and the farm wagons of beet, before and after their loads were shot out. The weight of the barges is also taken before and after unloading, by calculating displacement. In order to estimate a consignor's sugar percentage a sample is taken of every four tons lifted out of the barges, of every single wagon load when the beets are received by rail, and of every eight loads when they arrive by road.

As the novice never realises the quantity of water needed by a big sugar factory, it may be mentioned that at Dinteloord some 1,200 tons a day are used. The daily consumption of

lime is 42 tons. Coal costs nearly 9d. per ton of beets. The "campaign" staff, which numbers about 500 for day and night shifts, receives about £5,600 in wages. This does not include the pay of the heads of the factory or the office staff. As it is seldom that one hears of an estimator of the cost of an English factory saying anything about the expense of keeping the place in order when it is not working, it is worth noting that at Dinteloord, without counting head officials and the office staff, there are sixty men on the place after the sugar-making is over.

The shareholders receive wet pulp. Most of them live close at hand so that they prefer wet slices to dry, but the factory tries to squeeze out as much water as possible.

I was assured that only three out of the twenty-five joint stock sugar factories in the Netherlands pay for beets according to the percentage of sugar, in the same way as the co-operative ones do. After the season of 1910–11 Dinteloord paid off more than £4,000 in redemptions. As a result of this season (1911–12) it will probably carry more than £20,000 to reserve, and the members will be paid about 8*s*. 4*d*. more per ton for their beets than they would have got, so I was informed, from the joint stock companies.

The co-operative factory struck me as frugally, but efficiently planned. The co-operators reduce the amount of their machinery by contenting themselves with the production of an unrefined white sugar. It is thought that this is more profitable than refining, which means increased capital, a higher excise duty, and finding trade customers. Everyone who has thought about these considerations attaches weight to them, though an experienced sugar firm may well find a great advantage in refining as well as in simply making sugar.

Dinteloord has been happy in the time of its starting. After the Sas van Gent factory was started sugar prices went down; since Dinteloord's first season, prices have kept going up. The managing director laid the greatest stress on the help this had been. If old hands in sugar beet culture, not unacquainted with sugar manufacture, attach importance to such a piece of good fortune, how necessary it is that English factory promoters should be far-seeing and cautious. When I went

over the Dinteloord factory in November, most of the sugar had already been sold at good prices in advance of manufacture.

From the farmers' point of view, the co-operative factory is no doubt the ideal way of going to work: the agriculturist gets his profits as a beet grower and his dividend as a sugar manufacturer.

The managing director of the Dinteloord factory, who has large farming interests in Zeeland, told me that he would obtain 43 tons of beet per hectare (2½ acres), over an area of 118 hectares. He reckoned in fact that his crop would be over 5,000 tons. The analysis of his first cargo to arrive at the factory reached the high sugar percentage of 19·3, and in later cargoes he had touched 17 and higher, but, he said, "now the rain has come I may be down to 16 per cent." The highest sugar percentage is obtained after wheat and the least after clover and green manure. The English farmer who reads this should remember, of course, that this is experienced culture on highly suitable land.

MUSTARD BEETLES.

R. STEWART MACDOUGALL, M.A., D.Sc.

THE MUSTARD BEETLE (*Phaedon betulae*, Küst).

AMONG mustard enemies, *Phaedon betulae*, Küst (*armoraciae*, L.) is very destructive, both as adult and as larva; the leaves especially are destroyed, but the shoots are also gnawed. Scarcely a year passes without some damage by this beetle, and now and again many acres of mustard are spoiled by it. In 1886 Miss Ormerod collated a number of replies from mustard growers concerning this and other insect enemies of mustard, and made a report, which was printed in abstract in the *Journal of the Royal Agricultural Society* for 1897, and more fully in the Ormerod Annual Report for 1897.

Phaedon betulae, often known as the mustard beetle, while choosing mustard as a favourite crop for feeding and breeding on, uses as food plants other Crucifers, *e.g.*, cabbage, rape, turnip, swede, cress, and charlock. The beetle is found in England, Scotland, and Ireland. Complaints concerning it come to the Board chiefly from the east of England, but

in mid-June, 1904, adult beetles were sent from Bath, where they were destroying a bed of watercress.

Description of Beetle.

The adult (Fig. *a*) is broadly oval, and measures just over $\frac{1}{8}$ inch in length. In colour it is shining metallic blue or deep green; the antennæ, legs, and under-surface of the body are black. Fowler adds as characteristic, "anal segment of the abdomen with a broad and bright reddish testaceous border." The thorax, narrower in front, is markedly punctured. The wing-covers also show many punctures, these punctures being not only on the lines or striæ that run down the wing-covers, but also in the spaces between the striæ.

The larva, or grub (Fig. *b*), is smoky or dull yellow in colour, spotted with black, and is somewhat hairy; the head is black; the legs are six in number, and are black, but there is,

MUSTARD BEETLE (*Phaedon betulae*).
a. Beetle × 3; *b*, Larva, × 3.

in addition, a muscular process at the hind end. Along each side of the body is a row of tubercles, brown in colour; from these tubercles yellow glands can be protruded. The length of the grown grub is about $\frac{1}{4}$ inch. The grub newly hatched is bright yellow, but the colour becomes dull.

Life-History.

The adult beetles pass the winter in many different shelter-places at and in the neighbourhood of fields where the grubs have been at work—in such shelter-places as mustard stubble, hollow stems of wild plants, rubbish-heaps, at the base of rough grass, under bark, and in cracks in gate-posts and fences.

Issuing from their winter quarters in spring, the beetles lay their eggs on the under-sides of the leaves of mustard; the eggs are yellow. The grubs feed on the leaves, and many can be found on a single leaf. Adult beetles have been sent to the Board in May, June, July and August. The grubs, when full grown, drop away from the food-plants to the

ground, and pass into the soil for pupation; in a fortnight the new adults may come above ground. Both young and old plants are attacked.

Treatment.

1. The beetles may be collected by shaking them off the plants into vessels containing paraffin, or into receptacles coated with tar. The most satisfactory method for such trapping would be the use of a machine that could be pushed between the rows; the machine would be provided with strips of canvas and a catching apparatus in the form of troughs or scoops situated low down within five or six inches of the ground. The canvas strips would be so arranged as to hit against the plants as the machine was pushed between the rows, and thus cause the beetles to fall into the traps below.

Miss Ormerod wrote favourably of such a machine in her Report, 1894, while in 1911 such a machine, in process of being perfected, was exhibited at the Lancashire Agricultural Society's Show. Trapping the beetles before they had laid their eggs would be especially advantageous.

2. Where great numbers of eggs have been laid on young plants a few inches in height, the wisest measure would be to plough in the crop at once.

3. Against the grubs a useful spray would be arsenate of lead, care being taken that the spray reached the under-sides of the leaves. The arsenate of lead would be likely to poison any beetles that ate leaves sprayed with it.

4. Where, later in the year, the beetles are noticed to be migrating to other fields, a shallow trench should be dug across the path of the migrating swarm. If the trench be kept tarred many beetles will be caught.

5. After a bad attack by *Phaedon betulae*, the straw, where it has been left on the field, might, after lying for some time, be burnt in order to destroy sheltering beetles.

THE TURNIP, MUSTARD, AND CABBAGE FLOWER BEETLE (*Meligethes aeneus*, Fab.).

This tiny beetle, belonging to a different family from *Phaedon*, is an enemy to the seed crop of various Cruciferæ. It injures the flowers, and so reduces the amount of seed. Badly infested flowers shrivel. It is often harmful on mustard. It may be alone, or it may be present along with

Phaedon betulae, and is found both on white and on brown mustard. Thus on June 7th, 1909, a correspondent wrote: "I have eight acres of brown mustard, about a foot high, growing very fast. Yesterday I discovered all the tops of the plants covered with small black beetles." On examination these proved to be *Meligethes* and *Phaedon* working together.

The adult beetle is little more than $\frac{1}{12}$ inch long. It varies somewhat in colour, but typically is brassy green or deep green, with the thighs darker.

The larva is a grub with six walking legs on the thorax, and at the hind end of the body a process of service in locomotion. In colour the grubs are greyish or yellowish white; the head is dark.

Life-History.

The beetles lay their eggs in the opening buds, and both adult beetles and larvæ may be found at work in the blossom. The grub, on being full-fed, falls to the ground, and enters the soil for pupation.

OTHER PHAEDON SPECIES.

Phaedon cochleariae (F.) is smaller and brighter blue than *betulae,* and feeds on Crucifers.

Phaedon tumidulus (Gerv.) is found on Umbelliferous plants, *e.g.,* on the wild cow parsnip or hogweed (*Heracleum sphondylium*). I have had it from two Umbelliferous crop plants. In July, 1905, it was sent to me from Yorkshire as harmful to celery. The correspondent wrote: "The beetles seem to commence operations at one end of a row of plants, and work steadily along the row, absolutely destroying the plants; the beetles are in hundreds."

In August, 1905, it was sent to the Board from Settle, where, along with another *Chrysomelid,* it was destroying parsley.

Spurrey as a Forage Crop, and for use on Sandy Soils.

The identification and eradication of Spurrey (*Spergula arvensis,* L.) as a weed were dealt with in this *Journal* in July, 1911 (p. 292). In that article it was stated that "in certain Continental countries, especially Belgium, a variety of spurrey is grown as a fodder crop, and is even sometimes converted into

hay. In his *Farm Foods* Wolff quotes the following analyses of spurrey :—

	Green.		Hay.	
	Total.	Digestible.	Total.	Digestible.
Water	80·0	—	16·7	—
Crude Albumen	2·3	—	12·0	—
,, Fibre	5·3	3·3	22·0	13·1
Nitrogen-free Extract ...	9·7	6·5	36·6	23·7
Fat	0·7	0·3	3·2	1·9
Ash	2·0	—	9·5	—
Albuminoids and Amides	—	1·5	—	7·6

Very light sandy soils might be considerably improved by ploughing in several crops of spurrey in succession, for it will grow in profusion on sands where many plants would not succeed at all, and its growth is so rapid that two or three crops may be raised in one season. Ploughing in would of course be effected as soon as the weed showed the first flowers. Depasturing the crops with sheep would also be very beneficial on such soils."

Since the above note was published some further information on the subject has been collected.

Spurrey is referred to by Johnson and Sowerby in *Useful Plants of Great Britain*. Aberdeenshire farmers have long held it as a pernicious weed, and this view can readily be understood by anyone personally cognisant of the conditions which were to be met with, at any rate thirty years ago, on many farms where the soil was light and sandy. The spurrey grew so luxuriantly as to choke the crop that had been definitely sown, and it can be realised what were the feelings of those who lost a crop of turnips and got instead a crop of spurrey, which they did not aim at and did not know how to utilise. When Johnson wrote in 1865, the plant was grown for fodder in many parts of Europe outside the British Isles, and in various parts of this country also its qualities were rated very highly.

Many foreign writers have been enthusiastic in recommending spurrey as a green manure for sandy soils and as a fodder crop, especially on such soils. Thus in the *Dictionnaire d'Agriculture* (1892), it is stated that this plant is cultivated as a forage crop in Russia, Germany, and Belgium, but only to

a small extent in France. According to Belgian statistics the ordinary variety yields from about 2 to 9 tons of green forage per acre. Over an average of ten years the yield was more than 5 tons per acre. In 1866 8,645 acres were grown in Belgium, and the acreage had risen to 59,200 in 1880.* When used as a fodder crop successive sowings are made. Cattle eat spurrey green or dried, but horses do not seem to care for it. Spurrey is held to have a good influence on the quality of butter. In France it is regarded as particularly useful for ploughing in as green manure, or for forage at the end of a season of scarcity. For this purpose sowing may take place in July and August, and even early in September, about 22 lb. of seed per acre being sown.

In the *Monographie Agricole de la Région de la Campine*, issued in 1899 by the Belgian Ministère de l'Agriculture, spurrey is included as a matter of course among cultivated crops. It is stated that spurrey is an important plant in the Campine country, where the keeping of cattle for butter is the dominating consideration of the farmer. It furnishes an excellent fodder much relished by cattle, and favourably inducing milk secretion. Butter made from the milk of cows fed on this plant is termed "beurre de spergule," and is sought after as being of superior taste, aroma and good quality. Spurrey is well suited to the poor soils of the Campine, though it does better on richer soils. Two kinds are sown, the ordinary species and the Giant Spurrey. The latter is not widely distributed, but is more vigorous and productive and attains two or three times the height of the former. It is for this reason that it requires a soil better provided with plant food than in the case of the ordinary spurrey, which does well on poor soils. In trials at Limburg the giant variety yielded twice and even three times as much forage as the ordinary kind, but required 8 to 10 weeks for its complete development compared with 6 to 8 weeks for the latter kind. From the point of view of nutritive value, however, the ordinary kind is superior. On soils of medium quality it is recommended that the two kinds should be sown as a mixture. The crop is harvested by mowing or by pull-

* According to the *Agricultural Statistics*, 1910, Part IV., 59,485 acres were grown as a second crop in 1909, and 62,417 acres in 1908, the produce being 337,000 tons and 320,000 tons respectively.

ing by hand. Yields vary largely, according to soil and climate, but 4 to 5 tons of green fodder per acre—ordinary spurrey—would be considered good. The cultivation is simple: a shallow cultivation, one harrowing, sowing of the seed broadcast at the rate of 13 to 18 lb. per acre (or 22 to 27 lb. in the case of Giant Spurrey), and a final harrowing. Manuring is not practised. If the giant variety is sown too thinly it becomes hard and woody, loses its nutritive value, and is less liked by stock. In April most farmers in the Campine sow a small area of spurrey, which is useful for the stock for some days in June and July, while at the same time spurrey is sown for the purpose of producing seed, which is harvested about the end of July, when it is mown, dried, and thrashed with flails.

Experiments in Germany showed that manuring with nitrogenous fertilisers materially increased the yield of the crop, nitrate of soda being better than either sulphate of ammonia or calcium cyanamide (*Fühling's Landw. Zeitung*, 1907, p. 148).

Spurrey is strongly recommended for use on light sandy soils as a green manure, and also as forage, in Bulletin No. 91 (Feb. 1893) of the Michigan Agricultural Experiment Station. It is stated that the plant has proved of much value as a forage crop, but is far more valuable for ploughing in as green manure, its physical effect on light sandy lands being very marked. Indeed, it is considered of greater value for this purpose than any other plant similarly utilised on these soils. Sheep and cows were found to be very partial to the spurrey, and it is remarked that "It is in best condition for pasture from four to six weeks after sowing, though if necessary animals can be turned on much sooner. It furnishes excellent pasturage for cattle, especially milch cows, though they often refuse to taste it at first; but after once eating it will leave the richest clover pasture to return to it. Sheep seem to prefer it above all forage, and all stock thrive upon it, when cut or cured, even eating every particle of dry straw that has been threshed for seed." In a report on the trials, it is stated (*Rep. Mich. State Bd. of Agric.*, 1889, p. 81) that "Its value as a manurial plant on these light sands is pronounced. When ploughed under it seems to enrich the soil the most rapidly of all plants used. It

is valuable for a fodder plant, being eaten readily by cows and sheep. It is said to be very valuable for cows giving milk. It is a plant of first value in bringing these sands into productive fields." The Michigan Bulletin quotes several Belgian and other writers, who speak in high terms of the value of spurrey.

New Forms of Potash Manure.

It is now generally known that in ordinary farm practice crops have to be supplied with manures of one form or other containing the three materials referred to commercially as nitrogen or ammonia, phosphate, and potash, and that if a crop is starved as regards one of these, poor results will be obtained, no matter how much of the other two ingredients may be present and available. It is also a matter of common knowledge that there are several different sources of nitrogen and phosphate, and that we may regard the supplies as inexhaustible, but that in the case of potash the only sources of any consequence used at present are the deposits occurring at Stassfurt, in Germany.

At the same time, potash is a very common and widely distributed substance, and it has been estimated that it makes up about 2·8 per cent. of the earth's crust. The whole of this can be traced back to the original rocks—granite and others of similar composition—and to the more recently formed rocks of volcanic origin. The most important components of all these are various felspars, a family of minerals many of which contain potash in considerable quantities. Thus orthoclase, with its sub-variety sanidine, is a double silicate of potash and alumina, and contains when pure 16·89 per cent. of potash. Many other felspars and allied minerals consist of silicate of potash in association with alumina, soda, and lime.

Usually these potash-containing minerals are mixed with such large amounts of quartz, &c., that the amount of potash in the rock is only about 3 per cent., but in various parts of the world there are enormous deposits of rocks and minerals containing higher proportions. For instance, in several of the States of America, notably Maine, Connecticut, Pennsylvania, New York, and Maryland, in many parts of Norway,

and in the Eifel district of Germany, there are masses, usually volcanic in origin, of highly felspathic rocks containing up to 8 or 10 per cent. of potash in the form of double silicates.

In forming an estimate of the value of a material as manure it is not, however, sufficient to have merely the percentage of potash; the condition in which that potash exists must be known too. Potash in a soil or manure may be in either of two forms. It may be in an available state in which the plant can make use of it at once, or it may be in such a condition that years of "weathering" are necessary before the plant can take it up.

For instance, a clay soil will contain up to 2 per cent. or so of potash (also mainly in the form of double silicates), but this may become so slowly available for the use of the plants that application of soluble potash manure may be necessary to obtain maximum production from the soil.

The potash manures usually employed—kainit, sulphate, and muriate of potash—are soluble in water, and it is assumed that plants can make use of these at once if required. At the same time, owing to the absorbent properties of the soil, there is little fear of loss through drainage. In the case of the silicates referred to only a fraction of one per cent. of the potash is soluble in water, or weak acid corresponding to the dissolving power of the plant root, and the question arises as to how far it will become available for the use of crops in a reasonable time.

A considerable number of experiments have been carried out to test this point. Detailed reports and discussion of results will be found, for instance, in the *Transactions of the Highland and Agricultural Society of Scotland,* 1887; *Bulletin* 104, Bureau of Plant Industry, U.S. Dept. of Agriculture, published 1907; *Mitt. der Landw. Ins. Univ. Breslau,* 1911; *K. Landtbr. Akad. Handl. och Tidskr,* 49 (1910), No. 8 (*abs. Exp. Station Record,* U.S. Dept. of Agri., Vol. xxv., No. 5); *Deut. Landw. Presse,* 38 (1911), No. 63.

The results of these different experiments are to a great extent contradictory and inconclusive, possibly owing to the fact that the effect of a potash manure is seldom so clearly marked as that of nitrogenous or phosphatic manures. In

the case of some of the experiments, an examination of the results makes it appear probable that the soil originally contained sufficient potash to meet the requirements of the crop grown.

It is not intended, however, to discuss the experiments in detail, but to call attention to the importance of "availability." At the present time certain new substances are being offered as potash manures, and in such cases intending purchasers would do well to obtain an analysis showing the proportion of potash soluble in water. For purposes of comparison, it may be remembered that kainit usually contains about 12 per cent. of potash soluble in water.

Friskney Credit Society.

Friskney is a large rural parish in Lincolnshire, on the shore of the Wash, between Boston and Skegness. Its area is about 7,000 acres, and its population about 1,300, not at all closely packed together. Some of the land is fairly high-lying and dry, but much has been reclaimed from the fens on the one hand, and from the sea on the other. Much of it is of good quality, commanding rents up to £2 10*s*. or even £4 per acre. There are 121 small holdings of from 1 to 50 acres, besides 75 acres held in plots of an acre or less, generally in long, very narrow strips. Among the most paying crops are potatoes, cabbage, celery and mustard: early potatoes, which come into the market after the Jersey supply, sometimes fetch £25 or £30 per acre. Agriculture as practised by small occupiers is a prosperous business in this neighbourhood, and it is said that all dues and rates are punctually paid, and that it is seldom that a labourer is out of work.

Such a parish, with so many small agriculturists, some of whom own their holdings, is a suitable place for a Co-operative Credit Society; and owing mainly to the influence of Mr. Woodhead, J.P., who himself owns and works a moderately-sized farm in the parish, and of Mr. Robinson, the schoolmaster, such a Society was started in 1903, with the help of the Co-operative Banks Association, which has since been absorbed in the Agricultural Organisation Society. The

founders had also the benefit of the advice of Mr. Sutton-Nelthorpe, the Chairman of the pioneer credit society at Scawby in the same county. The rules adopted were of the same character as those that govern all the other 43 credit societies now at work in England and Wales. They provide that only residents of Friskney of good character can be members, that the liabilities of the members for debts due by the Society shall be unlimited, (except in the case of guarantor members), that loans shall be made only to members, and only for purposes which the Committee think are likely to prove profitable to the borrower, and that all profits from the working of the Society shall be carried to a reserve fund which cannot be divided among the members.

The Society began with 20 members, and the number gradually increased, till in 1911 there were 33. They include 13 farmers, 6 labourers, 3 farm servants, 2 cottagers, a wheelwright, a blacksmith, a road foreman, a grocer, an overseer, an engine-driver, a builder, the schoolmaster and the Vicar. Twelve of the members are owners of land. Mr. Woodhead has been chairman from the beginning, the Secretary is a road-surveyor, and the schoolmaster is Treasurer. The Committee of seven, who are elected by the members every year, now include two farmers, the Vicar, a grocer, a blacksmith and a labourer. The Secretary receives a salary of £1 per annum, but the rest of the work is done free of cost to the Society, and the total cost of management, including salary, stationery, affiliation fee to the Agricultural Organisation Society, etc., was only £1 10*s.* 1*d.* last year.

The Society has from the beginning charged only 5 per cent. on loans to its members—that is, one penny per pound per month. It began by making three loans amounting to £50 in its first year, and last year advanced six loans amounting to £89. In the last 8 years it has made 33 loans of the total amount of £515, averaging £16 per loan. The loans were all made to members for profitable purposes, and have been repaid punctually, though in some cases the Committee have seen fit to extend the time fixed for repayment for good cause shown. At the end of 1911 there were 14 loans outstanding of the aggregate amount of £196, none

of them overdue. Five loans were made to enable the borrowers to take small holdings, five to enable them to retain stock for better prices, two to buy seed potatoes and pigs, one for the purchase of stock, and another for the purchase of a reaper.

In order to obtain money to meet these loans the Society began by offering to take deposits at 3 per cent., and in the first year received £82 on these terms. It has since received and paid deposits every year, and at the end of 1911 held £152 deposited by 9 persons, 5 of whom were members, and 4 non-members. Last year, finding the amount required for loans was more than the amount received on deposits, it raised the rate of interest paid on deposits to 3½ per cent. It also borrowed £20 from a bank at 5 per cent., and £30 from an Insurance Company at 4 per cent., which shows that its credit is good.

For the first three years of its working, the Society's profits were not enough to pay the Secretary's salary of £1, and the net result of the year's working showed a small loss. Since then there has been a profit every year, and at the end of the year 1911, the balance-sheet showed that the total profits up to date amounted to £8 7*s*. 2*d*., as follows: Assets £205 7*s*. 2*d*., including £196 out on loan to members: Liabilities £197, of which £152 were due to depositors, £15 to a Bank, and £30 to an Insurance Company. The surplus of £8 7*s*. 2*d*., which represents accumulated profits, forms an indivisible reserve fund, and is the property of the Society, on which it pays no interest.

Here then we have a society managed by the villagers themselves, with practically no help from outside, on sound business principles. It has been able to borrow at low rates of interest on the credit it has built up for itself by good and careful management, and has been able to make loans to its members for profitable agricultural purposes at 5 per cent. per annum. As the reserve fund grows, and the interest obtained on it increases, the Society may look forward to being able to lend to its members at even a lower rate than 5 per cent., which is itself a rate at which few small agriculturists outside these credit societies can borrow, if they can borrow at all.

Costs of Production in Agriculture.

One of the objects to which the grant for Agricultural Research, recently placed at the disposal of the Board of Agriculture and Fisheries, will be devoted is the maintenance of an Institute for the study of the Economics of Agriculture, a subject of which little has been heard hitherto in this country. A marked feature of the progress in recent years in the technique of business management has been the prominence given to what are technically known as "costs." The majority of large manufacturing concerns have nowadays a costs department, one of whose functions it is to ascertain and record the cost of each operation that is required to convert the raw material into the finished article ready for the market. Thus, if the manufactured product is worth a sovereign, the costs department ascertains to the fraction of a penny the value of the raw material used, the cost of labour at each successive stage of manufacture, and even such details as, say, the cost of the coal used in producing power for any necessary machinery, the fractional share of management charges properly debitable to the article in question, and so on, in as minute detail as may be considered desirable. It is thus possible to institute comparisons and so check waste, to drop unprofitable "lines," and develop profitable departments.

So far, work of this kind has not been done in relation to agriculture in this country, but a beginning has been made in the United States by the Bureau of Statistics, and some interesting papers on the subject will be found among the publications of that department.

The need for accurate information on the cost of agricultural operations may be illustrated from the recent controversy in the daily press on the subject of the cost of growing sugar beet. No general agreement has been reached on this vital question—vital because on the answer to it the useful employment of many thousand pounds of capital may depend —and estimates differing by 100 per cent. from one another have their advocates, each of whom produces an ostensibly convincing array of figures. A common feature of all these figures is that they are based on arbitrary assumptions as to the cost of such things as, for example, horse labour, a subject

which gave rise to an animated and inconclusive discussion of experts at a meeting of the British Association two years ago. Another fruitful subject of conflicting views arises from the question: What is the cost of producing beef or mutton? Some experts say that the profit is nil, others that corn-growing does not pay, but stock-keeping does. The controversy arises because there is no foundation of hard statistical fact on which to build. No one has come forward, for example, to say that he has collated figures from one hundred typical farms, and that the prevailing cost of keeping a horse is so much, and that on the average it works so many hours per diem, two figures which, if obtained, would go far to settling the question. As a rule, farming does pay, but the question as to what description of farming pays best under defined conditions, and why, cannot be answered.

The method adopted by the United States Bureau of Statistics is to place qualified persons on the farms to keep or obtain records of the times spent on each description of agricultural work, the exact weight, and, as far as possible, cost, of all materials produced or consumed on the farm. The particulars so obtained are carefully abstracted and tabulated, and precise information as to costs is obtained. The following are typical examples:—

AVERAGE ANNUAL COST PER ACRE OF FARM MACHINERY IN MINNESOTA.

	Dollars.
Binders	0·181 (9*d.*)
Drills	0·075 (3½*d.*)
Ploughs	0·087 (4*d.*)
Threshing outfit ...	0·335 (1*s.* 5*d.*)

These figures are based on averages for a large number of figures for (1) original cost of the machines; (2) number of years in use; (3) depreciation; (4) repairs; (5) acres operated on per year.

AVERAGE ANNUAL COST OF MAINTAINING A FARM HORSE IN MINNESOTA.

	Dollars.	
Interest on investment...	5·54	
Depreciation of horse	5·56	
,, ,, harness	2·10	
Shoeing	1·42	
Food	63·49	
Labour	11·88	
Miscellaneous	0·40	
Total	90·40	[=£18 16*s.*]

Average number of hours worked per day = 2⅔
Cost per working hour = 0·0925 [= 4·6*d.*]

It cannot be suggested that these figures are applicable to this country. The point of interest is that they are based on the average of a large number of actual figures obtained over a series of years on many farms, and consequently represent fact, not opinion.

It is necessary, however, to point out that the issues appear to be simpler in the States, in so far as agriculture there seems more specialised, and consequently less complex from a book-keeping point of view. A farmer who confines himself to producing wheat or cotton has a much simpler problem of costs to solve than one who takes up mixed farming in this country, and has to combine corn-growing with beef or mutton production, and, perhaps, horse-breeding as well. Then, again, intensive farming and its necessary accompaniment, an approved rotation of crops, presents a more difficult problem.

Changes in the Number and Size of Agricultural Holdings.

The Acreage and Live Stock returns of Great Britain for 1911 again show an increase in the number of small holdings. The number of holdings of the smallest class—1 to 5 acres—increased in England and Wales during the year 1910–11 by 2,085 and in the 5 to 50 acre class by 1,601, so that the total increase during the year was 3,686. So substantial was this increase that the number of small holdings in England and Wales is now greater than in 1903.

From 1903 to 1908 small holdings declined steadily in England, and although in Wales there was no general tendency, the lowest point in England and Wales as a whole was reached in 1908. This continued decline was only consistent with the tendency disclosed by previous periodic returns at various dates. Thus in 1890 the number was calculated at 309,290 and in 1895 it had fallen to 299,378. In the three years since 1908, however, there has been an increase of 5,312 or nearly 2 per cent. The changes in the number of holdings of from 1 to 50 acres in size are shown in the first table on the next page.

The above figures represent only net increase and not the number of new small holdings created. The contraction of the

cultivated area year by year involves the disappearance of a number of holdings, and probably small holdings are

Year.	England.	Wales.	Total of England and Wales.
1890 *	267,346	41,944	309,290
1895	257,646	41,732	299,378
1903	248,936	41,735	290,671
1904	248,104	41,895	289,999
1905	247,854	42,013	289,867
1906	246,934	41,992	288,926
1907	246,896	42,197	289,093
1908	245,102	42,074	287,176
1909	245,856	42,155	288,011
1910	246,584	42,218	288,802
1911	250,166	42,322	292,488

* The holdings of one acre have been deducted in the proportion ascertained in 1895.

swallowed up by urban encroachments in greater numbers than larger farms. Indeed, to this cause the diminution of small holdings in earlier years was largely attributed. Not only, therefore, has the creation of small holdings since 1908 been sufficient to make good this wastage, but to increase substantially the total number of small holdings in the country.

An indication of the extent to which the larger holdings are being broken up to satisfy the demand for small holdings is afforded by the figures in the following table showing the changes in the number of holdings of all sizes in England and Wales.

—	1 to 5 acres.		5 to 50 acres.		50 to 300 acres.		Over 300 acres.	
	1911.	1910.	1911.	1910.	1911.	910.	1911.	910.
England.	82,538	80,429	167,628	166,155	110,110	109,981	14,377	14,531
Wales....	10,210	10,234	32,112	31,984	17,965	17,996	370	364
England and Wales	92,748	90,663	199,740	198,139	128,075	127,977	14,747	14,895

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

FIELD CROPS.

Influence of Time of Cutting upon the Yield and Composition of Hay (*Jour. Agric. Sci., January,* 1912 : *Dr. C. Crowther and Mr. A. G. Ruston, Univ. of Leeds*).—The variation in the composition of fodder crops with advancing maturity has been well investigated on the Continent, but has received little attention in this country. In view of the differences in climatic conditions, it seemed doubtful if the changes in the composition of fodder crops would take place so rapidly here as on the Continent, where a delay of only a few days in cutting has apparently led to a serious depreciation of the crop. Records are therefore given of tests made with "seeds" hay grown in Yorkshire. In each case the hay was the produce of a seeds mixture in which clovers predominated, though in the second year of the test the leguminous plants were not so well established, so that the hay was to a greater extent composed of rye grass.

The first cuttings in each year were made when the rye grass was in full flower, and three other plots were cut at intervals of about a fortnight. At the second cutting the rye grasses were distinctly taller, and seed formation was actively in progress, whilst the clovers were beginning to flower. At the third cutting the grasses were ripening, and the clovers were in full bloom, while at the last cutting the whole crop was decidedly ripe.

Care was taken to prevent mechanical loss, but had the crop been harvested in the usual way, there would have been considerable loss of seeds, &c., at the time of the fourth cutting. The crops obtained in the two years were as follows :—

1909 CROP.		1910 CROP.	
Date of Cutting.	Yield of Hay per acre.	Date of Cutting.	Yield of Hay per acre.
June 10	32 cwt.	June 9	34 cwt.
,, 28	42 ,,	,, 23	46 ,,
July 15	48 ,,	July 7	47 ,,
Aug. 3	50 ,,	,, 21	50 ,,

The crop of hay obtained from each cutting was analysed and estimation made of its digestibility and feeding value.

Taking the results of the two years, the chief changes going on in the period were :—

(1) A steady increase in the proportion of crude fibre;

(2) A gradual fall in the proportion of amides up to the third cutting, after which the fall was very pronounced;

(3) A rise in the percentage of silica in the ash.

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

	Pounds Per Acre in the Different Crops, 1909.			
	1st Cutting.	2nd Cutting.	3rd Cutting.	4th Cutting.
Total Dry Matter	3,220	4,180	4,800	5,100
Crude Protein, including	470	535	635	610
True Protein	330	390	465	520
"Amides"	140	145	170	90
Ether Extract, (Fats, &c.)	85	70	75	75
Crude Fibre	880	1,280	1,520	1,760
Pentosans	670	930	1,160	1,230
Soluble Carbohydrates ...	830	1,040	980	940
Total Ash, including ...	285	330	425	490
Silica	43	61	112	127
Lime	27	28	40	39
Phosphoric Acid ...	18	13	15	20
Potash	41	42	42	55

The digestibility of the different crops was estimated, and the starch equivalent calculated.

The starch equivalents of the total crop per acre in 1909 were as follows :—

	For Maintenance.	For Production.
1st Cutting	2,000 lb.	1,300 lb.
2nd ,, ...	2,500 ,,	1,530 ,,
3rd ,, ...	2,740 ,,	1,610 ,,
4th ,, ...	2,700 ,,	1,490 ,,

It is concluded that in both years the third cutting gave the most valuable crop, but a fair amount of latitude in the time of cutting—say, a week or ten days—may be allowed without seriously impairing the nutritive value of the crop.

If left too long, the fall in the digestibility more than counterbalanced the increase in the weight of the crop, even though no mechanical loss of seeds, &c., took place, a loss which could not be prevented in ordinary farm practice.

Varieties of Barley (*Beds. C.C., Agric. Educ. Com., Report upon the Barley and Sugar Beet Plots,* 1911).—Ten varieties of barley were tested in 1911 on a light, sandy soil. In consequence of the hot, dry weather, the crop ripened off too quickly, and, in addition, all the plots were damaged by smut. In this year Maltster gave the heaviest yield, and Princess (a new Svalof variety) the lowest, while Standwell, though unsatisfactory as regards weight of crop, produced the best quality sample. The average yields per acre in the five previous years were : Kinver Chevalier, 43 bush. ; Goldthorpe and Prize Prolific, 40 bush. ; Maltster and Burton Malting, 39 bush. ; Standwell, 38 bush. ; and Binder, 37 bush.

Growth of Sugar Beet (*Beds. C.C., Agric. Educ. Com., Report upon the Barley and Sugar Beet Plots,* 1911).—In 1911 the various experiments were carried out at Ridgmont under a scheme assisted by the Board with a view to comparing results obtained with sugar beet in various districts. The soil on the field in which the plots were laid out was a somewhat heavy clay. It was dunged in the previous autumn at the rate of about 15 to 16 tons per acre, and twice ploughed. Tables are given showing the weights of *washed and trimmed* roots obtained under various conditions. A few of the most important results may be selected for note.

When grown on the flat in rows 18 in. apart, the weight of washed roots was 12 tons 12½ cwt. per acre, as compared with 11 tons 13 cwt. and 9 tons 13 cwt. when grown in rows 21 in. and 27 in. apart respectively. Of the varieties tried, Rabbethge and Giesecke's Klein Wanzleben gave the heaviest crop—15 tons 7 cwt.

Different artificial manures to supplement the dung were tried.

The percentage of sugar varied very little; it was between 18 per cent. and 19 per cent. on all the plots, except where the beet was grown in rows 27 in. apart, in which case it was only 17·7 per cent.

Valuing horse labour at 2*s.* 3*d.* a day, farmyard manure at 4*s.* 6*d.* a load, and other items at actual prices, the cost per acre of growing beet on the flat in 18-in. rows was £13 1*s.* 2*d.*, against which is set the crop of 12½ tons of washed roots. This is compared with an acre of mangolds, which, in rows 27 in. apart, cost £10 16*s.* 4*d.*, and gave a crop of 20 tons.

SOILS AND MANURES.

The Phosphate Nutrition of Plants (*Jour. Agric. Sci., January,* 1912: *Mr. A. Baguley, Univ. Coll. of N. Wales*).—A good deal of experimental work has been carried out to determine the value of finely ground naturally occurring mineral phosphates as manures for plants of various kinds. In the experiments recorded in this paper the question was approached by artificially preparing insoluble phosphates of various kinds, and giving them as the only source of phosphoric acid to plants grown in pure sand.

In this way ferric-, aluminium-, and calcium-phosphates were tried with oats, swedes, and peas, and as a control the same plants were grown with superphosphate as the source of phosphoric acid. With aluminium and ferric phosphate, both oats and swedes turned out finer and healthier plants than with superphosphate. Peas grew into healthy, sturdy plants, but were not so early or fruitful as when grown with superphosphate.

With calcium phosphate the results were different. Oats did not thrive any better than those grown without phosphate at all, and died without producing any ears. Until about six weeks after sowing, the swedes appeared to do as badly as the oats had done, but then they began to grow vigorously, and at the end of the season they were good, healthy plants, though by no means so forward as the others. Peas grew moderately well with calcium phosphate, but the plants ripened early, and the crop was poor.

Rothamsted Experimental Plots in 1911 (*Annual Report of the Rothamsted Exptl. Sta.,* 1911).—The effects of the exceptionally hot, dry summer of 1911 were well marked on the different crops and plots. In the case of wheat the yields were good, the continuously unmanured plot giving 12½ bush. per acre, and the plot grown after a bare fallow in alternate years 17 bush. per acre, which is higher than for many years past. The weights per bushel were remarkably high, the average of all the plots being 65·5 lb.; the weight on one plot was 66·8 lb., the highest figures yet recorded. Barley was exceptionally poor, and the continuously unmanured plot yielded less than 5 bush. per acre.

On land cropped with them every year, mangolds were almost a failure, except on the plots receiving farmyard manure. On others the soil caked and germinating seed was unable to get to the surface.

Where, however, farmyard manure was given, the texture of the soil was so much better that a good plant, and crops up to 21 tons per acre, were obtained.

In a comparative test with various forms of nitrogenous manure for mangolds, nitrate of soda gave better results than nitrate of lime, sulphate of ammonia, and calcium cyanamide.

Manuring for Milk (*Midland Agric. and Dairy Coll., Bull.* 2, 1911–12).—This experiment, previously noted (*Journal,* August, 1911, p. 416, and January, 1911, p. 852), was continued in the year 1911, and the results of the grazing in that year are given in the Bulletin forming the Third Interim Report.

The experiment was begun in 1909, when two plots of 4 acres each were laid out in a grass field, which, through bad management in laying down, and annual removal of hay, was in a very poor condition. In the spring of 1909 both plots received 10 cwt. of ground lime per acre. One of them received in addition 4 cwt. superphosphate and 1½ cwt. sulphate of potash per acre, and during the three years the two plots have been grazed separately by cows in milk to determine the improvement due to the superphosphate and the sulphate of potash. No manures have been given to either plot since 1909.

In 1911 the effect of the manures was not so marked as in the previous season, and, owing to the dry season, the yields of milk from both plots were adversely affected. In spite of these, the manured plot increased the yield of milk at the rate of 81 gallons an acre for the grazing season, compared with the yield produced by the unmanured plot. In 1909 the difference was 84 gallons, and in 1910 86 gallons per acre. As the cost of the manures was only 29*s.* an acre, the manuring has even up to the present resulted in a handsome profit, and its effect appears to be by no means exhausted.

The Manurial Value of Phosphoric Acid contained in Oil Cakes (*Jour. Coll. of Agric., Imp. Univ. of Tokyo, Vol.* I., No. 3, 1911).—In Japan, oil cakes are largely used as manures, and it is pointed out that while they are chiefly valued as a source of nitrogen, they also contain appreciable quantities of phosphoric acid, *e.g.*, analyses of soy bean cake and rape seed cake show 1·3 per cent. and 2·25 per cent. respectively of total phosphoric acid. Experiments previously carried out have, however, indicated that this is in a much less available condition than that in animal manures, such as steamed bone flour.

The greater part of the phosphoric acid appears to be contained in a substance, phytin, which is split up under the action of an enzyme, phytase, and the phosphoric acid liberated in a soluble inorganic compound.

The experiments, of which an account is given, were designed to test how far the low availability of the phosphoric acid in rape seed and soy bean cake is due to the destruction or weakening of the phytase in the heating during the extraction of oil, and to see if the availability could not be increased by adding to the cake a quantity of rice bran—a substance which contains considerable quantities of the phytin-splitting enzyme.

It was found that rice bran did, under suitable conditions, transform the organic phosphoric compounds of the cakes to simple inorganic soluble ones.

WEEDS, INSECT AND FUNGUS PESTS.

Tall Oat Grass and Onion Couch (*Jour. Agric. Sci., January,* 1912).—One of the commonest grasses in this country is Tall Oat Grass (*Arrhenatherum avenaceum,* Beauvais), and it is occasionally included in the "seeds" mixture for temporary or permanent pasture. In some localities a form of this grass, known as Onion Couch [or Knot Grass or Pearl Grass], becomes an extremely objectionable weed on arable land. This plant is identical in appearance with Tall Oat Grass, except that at the base of the stems a chain of bulbs is formed. Each bulb is capable of giving rise to a new plant, and as cultivation merely breaks up the chain of bulbs, the weed is extremely difficult to eradicate, while a liberal supply of seed is formed in June and July.

Botanists differ as to whether the Tall Oat Grass and the Onion Couch are distinct species, or whether the bulbous form is assumed as a result of variation in conditions of habitat.

To test this point, seeds of Onion Couch were gathered from various localities and sown by Miss L. M. Underwood at Rothamsted in various soils with different amounts of moisture, shade, and at different rates. The two kinds of seed, which were indistinguishable, were sown in September and were well up before winter set in. Bulbs began to appear in the following March, and by May all the pots sown with seed from the Onion Couch were producing chains of bulbs, while the plants from Tall Oat Grass Seed remained normal.

It is concluded that the habit of forming bulbs is hereditary, and does not depend on the conditions of the habitat. Except for the bulbs, no difference could be noted between the two plants.

Investigations on Potato Diseases (*Jour. Dept. of Agric. and Tech. Inst. for Ireland, January,* 1912).—The Third Report, by Mr. G. H. Pethybridge, gives an account of the work done in 1911 at the temporary research station at Clifden, Co. Galway. Owing to the exceptionally dry summer, comparatively little damage was done to the potato crop by the various diseases, and the investigations were therefore carried out under unfavourable conditions. Various experiments were made with regard to the prevention of ordinary "blight" or potato disease (*Phytophthora infestans,* de Bary), and the results may be summarised as follows:—

(1) Bordeaux mixture made with lime was slightly more effective than when soda was used, though it is pointed out that the mixture with soda is more easily prepared.

(2) The plots sprayed twice, starting late (July 17th), were least attacked by disease. This was owing to the dry July and August, in which disease made little headway, but it did develop in the wetter September, and the latest sprayed plants were better fitted to resist it. The conclusion previously arrived at—that spraying prevents disease best when done before a period of wet weather—is thus confirmed.

(3) Even in a dry summer like 1911 spraying was effective and profitable, not only in the West of Ireland, but also in the drier climate of Co. Dublin, where it resulted in an increase in total crop of about two tons per acre, and reduced the proportion of diseased tubers.

(4) Lime-sulphur spray was found to be utterly useless in warding off the disease.

(5) Soaking "seed" in copper sulphate solution and in Bordeaux

mixture injured the tubers without preventing disease. It was, however, found possible to destroy the fungus on diseased tubers (without seriously affecting the vitality of the tubers) by heating to 50° C.

Attempts to discover the exact source of infection of tubers did not yield conclusive results, though it seems probable that it is not due to a preliminary contamination of the soil with resting spores from a previous season.

The Stalk or Sclerotium Disease.—It was concluded in 1910 that plants are infected with this disease by air-borne spores, and not by mycelium or spawn in or on the surface of the soil. This was confirmed in 1911, when some old grass land was broken up and planted with potatoes. The soil was free from the disease, and yet very many of the plants were affected by the stalk disease, infection doubtless taking place from spores borne by the air from "spore-cups" present in abundance on neighbouring land.

The Stalk disease appeared to suffer no check from the dry season, and about the end of July had made such progress that a couple of nights of strong wind broke down the infected plants at the point of infection.

Various methods of treatment to prevent this disease were experimented with, but were quite ineffective. A very striking result was, however, obtained on a plot which was planted late (May 27th), as compared with April 6th in the other plots. Only 5 per cent. of the plants on this plot were attacked, as against from 95 per cent. to 100 per cent. on the others. The total yield of potatoes was, however, somewhat seriously reduced.

Black Stalk Rot and *Corky Scab* were much less prevalent than in previous years, and it was impossible to obtain definite results, though in the case of the Scab, application of Flowers of Sulphur at the rate of 6½ cwt. per acre appeared to be beneficial, as it not only reduced the proportion of diseased tubers, but increased the total crop. Short accounts are also given of "Leaf-curl" and "Leaf-roll," "Sprain," "A new form of Tuber-Rot," and "Pitting Experiments." (A note on the 1910 investigations appeared in this *Journal* for August, 1911, p. 419.)

A Disease of Sweet Peas, Asters, and other Plants (*Roy. Bot. Gard., Kew, Bull. Misc. Inform., No.* 1, 1912).—Mr. G. Massee describes the minute parasitic fungus (*Thielavia basicola,* Zopf), and gives an account of investigations carried out at Kew. In recent years the damage done to asters and sweet peas has been so extensive in some localities that their cultivation has had to be abandoned. Culinary peas and many other plants may also be affected, while in Europe and the United States tobacco has suffered to a serious extent. The symptoms vary a little according to the extent to which the soil is infected, but generally the disease is only serious during the seedling stage. In the case of peas, both the plumule and radicle may be attacked, and then the seedlings will not appear above ground at all. More commonly, however, the root only is directly affected, in which case the plant attains considerable growth, then suddenly wilts, turns yellow, and dies. Another very common symptom is known to growers of sweet peas as "streak" or "stripe," characterised by the presence of dingy yellow streaks on the stem and leaves. In asters the plants are killed outright during the seedling stage; when about 3 in. high they begin to wilt, and

soon fall over, as in the disease known as "damping off." In both peas and asters the roots of diseased plants are shrivelled and blackened.

Infection appears to take place only from the soil, and the disease is often spread by means of manure, on which material the fungus flourishes and reproduces itself at a rapid rate. It is practically impossible to cure affected plants, but preventive measures can be taken, and in the article directions are given for sterilising the soil by means of dilute solutions of formalin.

Varieties of Potatoes immune to Wart Disease.—A small experiment was carried out last season at Abertillery in Monmouthshire on the lines adopted by the Board in the experiments described in the February number of the *Journal*, p. 915. A plot infected with Wart Disease of potatoes was selected and planted with potatoes known to be susceptible to the disease, as well as those believed to be immune. The resistant varieties planted were Aberlady Early, Conquest, Golden Wonder and Langworthy. These all proved immune, were white when cooked, and, except Golden Wonder, were floury. The following report was made on their quality: Aberlady Early, excellent, a very satisfactory potato; Conquest, excellent; Langworthy, very good; Golden Wonder, fair, rather small.

The potatoes of the other varieties tried were all badly affected with the disease.

A New Insect Pest of Mangolds and Beet (*Second Report on Economic Biology, by W. E. Collinge,* 1912).—During May, 1911, larvæ of *Cionus scrophulariæ,* Linn., were received on mangold and beet leaves, to which they were doing considerable damage. Hitherto no account of this insect attacking cultivated plants has been recorded, and it has not been regarded as of any economic importance, except for the fact that it feeds upon the knotted figwort (*Scrophularia nodosa,* Linn.), and to a certain extent keeps down that weed.

Contact Insecticides (*Michigan Agric. Coll., Tech. Bull. No.* 11).—The term "contact insecticide" is used as referring to those substances which kill through coming in contact with the outer surface of the insect body in contradistinction to those which must be eaten to be effective. Little work has been done to determine exactly how such substances kill, but the belief commonly held is that they act by plugging up the breathing pores, thus causing death by suffocation. This was the first point tested in the experiments reported on in this bulletin. It was found extremely difficult to kill many insects in a reasonable time merely by depriving them of air, and it is concluded that the certain and fairly rapid death caused by such materials as kerosene and gasolene cannot be due to the stoppage of the tracheæ alone. It was also found that air saturated with the vapour of various insecticides was nearly as effective as the liquids themselves. Further tests showed that in the use of many insecticides, such as kerosene, gasolene, creolin and pyrethrum, vapour penetrated the tissues and caused death long before the liquid or powder itself had time to penetrate the chitin, or to cause suffocation by the plugging of the tracheæ. The evidence gathered seemed to show that the vapours after absorption in the insect body become mainly effective through some tendency their presence exerts to prevent absorption of oxygen by the tissues.

Effect of Lime-Sulphur Wash on Scale Insects (*Michigan Agric. Coll., Tech. Bull. No.* 11).—Lime-sulphur wash is recognised as being a special rather than a general insecticide, and is recommended by entomologists as being particularly effective against scale insects. Its action was found to be peculiar. Unlike the other contact insecticides reported on, no proof could be obtained that lime-sulphur wash had penetrated into the tissues of insects. It appeared to have very little effect on large insects having heavy chitinous walls, and even when applied to a small portion of a very delicate body-wall, such as the body of a covered scale insect, that part might be killed before the rest of the body.

Various theories were tested, but it was finally concluded that its action on scale insects was due partly to the fact that it takes up oxygen in comparatively large quantities, thus indirectly suffocating the insect which it covers, and partly to its effect on the wax at the margin of the scale. It was found that this was affected by the wash, with the result that the insects were absolutely sealed in under the scale covering.

DISEASES OF LIVE STOCK.

Diseases of Live Stock (*Board of Agriculture and Fisheries, Rept. of Proceedings under Disease of Animals Acts,* 1910).—This report includes particulars of special investigations carried out at the Board's Veterinary laboratory.

Habits of Ticks.—During the last five years, ticks have been obtained for experimental observations in connection with the part they play as carriers of disease. In the course of these a considerable amount of information as to their habits was obtained, and a summary of this is given. The report deals with *Hæmaphysalis punctata,* which occurs on both cattle and sheep in this country. The life-cycle was found to be as follows:—(1) Hatching of the eggs takes place mainly in July, and, to a much less extent, in August; (2) if opportunity occurs, as it must in most cases, the larvæ become engorged almost at once, and moult to nymphæ, mainly in August and September, and to a less extent in October; (3) the nymphæ fill themselves, given a host, mainly in August, September, and October of the same year, and a considerable proportion moult to adults from September onwards; many nymphæ do not engorge or moult until the following spring; (4) the engorged females do not as a rule start laying until spring. Some may lay in February, but the majority not till May or June. Whatever be the date of laying, hatching appears only to take place after the beginning of July.

While a cycle of 95 days from engorged female to engorged female is theoretically possible, it is highly probable that in most cases the actual period is about 290 days. It is suggested that when dipping for the suppression of ticks (this, of course, does not refer to "keds," which farmers sometimes erroneously call sheep ticks) is carried out it should be done in April or May, and in October or November, as at these two periods the greatest numbers are likely to be caught engorging themselves at one time. To guard against dissemination of ticks, dipping should be carried out before moving animals from an infected country or district.

Bracken Poisoning.—In connection with so-called bracken poisoning, to which reference was made in the report for 1909, experimental feeding on bracken again failed to produce the characteristic symptoms of the disease. In one case the owner of affected cattle attributed the illness to Tormentil (*Potentilla tormentilla,* Linn.), and a heifer fed at the laboratory on this weed, taken from the pasture where illness was prevalent, became affected, and, on examination, showed all the appearances associated with the mysterious "bracken poisoning." It is pointed out, however, that there is a distinct possibility of the tormentil—which is a common weed in most parts of the country, and usually regarded as harmless—having merely acted as the carrier of some form of contagion from the pasture on which sick animals were grazing.

Origin of Thoracic Tuberculosis in Calves (*Journal of Comparative Pathology and Therapeutics, September,* 1911).—In this article, taken from the *Annales de l'Institut Pasteur,* Vol. xxv., No. 7, M. P. Chaussé describes some of the recent work carried out to compare inhalation and ingestion as means of infection in tuberculosis, and gives an account of experiments carried out by himself in this connection. Both lambs and calves were submitted to infection in the two ways. It was found that when virulent material, taken from diseased animals, was (after being diluted very considerably) sprayed into the air of the houses where animals were kept, tuberculosis of the lungs was contracted in every case. The disease was not so easily produced by *feeding* animals with the infective material, and from this, taken along with the results of his examination of the carcasses of a large number of young calves, the writer argues that in about 90 per cent. of cases tuberculosis in calves is caused by inhalation, and in only very few is infection produced through the food.

From this, the conclusion is drawn that in children the risk of infection through consuming cows' milk is slight compared with the chances of infection through being placed in intimate contact with tuberculous people, especially in insanitary surroundings.

HORTICULTURE.

The Effect of Grass on Trees (*Thirteenth Report of the Woburn Experimental Fruit Farm,* 1911).—In their Third Report, the Duke of Bedford and Mr. Spencer U. Pickering drew attention to the extent of the damage done to young fruit trees by grass. In the report under notice an account is given of experimental work that has been carried out since then, to test further the effect of the grass and to try to obtain a satisfactory explanation of its action.

It has been found that the extent of the effect depends on certain conditions, such as character of soil, age and kind of tree, and the rate at which grass spreads over the area cleared when the tree is planted, but in all the experiments extending over sixteen years, and carried out at several centres, there was only one case in which the deleterious action of the grass was not marked. In the majority of cases it was considerable, and in many it caused the death of the tree. In none of the experiments has any recovery from the effect been noticed, except in cases where the roots have extended beyond the grassed area into cultivated ground. Ten years' records of the

trials at Ridgmont show that the value of the fruit obtained from dwarf apple-trees grown in grass was only 7 per cent. of that obtained from trees grown in cultivated ground exactly similar in all other respects. It is, however, pointed out that the majority of the trials were so planned that the effect of the grass would be exercised to a maximum extent—the trees were young, and the grass did not spread gradually over the ground, but seed was sown (or turf replaced) immediately after the tree had been planted. Where the grassing over proceeds gradually, the trees apparently accommodate themselves to the altering conditions, and suffer much less than when the grass is actually sown over their roots. The fact that a tree has become well established in the ground before the land is grassed does not, however, prevent it suffering.

Standards on the free stock and dwarfs on the paradise were almost equally affected, though some varieties of apple were less affected than others, owing, doubtless, to their vigour of growth. Pears, plums, and cherries were also affected, though in the case of these trees the standards suffered less than the dwarfs.

One of the most striking facts is that the action became noticeable as soon as any of the roots of the tree had entered a grassed area, no matter how small was the proportion of such roots to the whole root system of the tree.

It is suggested that in some soils, where the effect produced is not great, grass might be advantageous from a commercial point of view, for the check given to growth tends to increase the cropping, and grass affects the colouring matter of all parts of the tree, generally resulting in a high colouring of the fruit.

Forest trees appeared to be affected by grass in the same way as fruit trees when grass was sown immediately after planting, though in the case of conifers on a light soil the effect was much less than with other trees, and some recovery gradually took place.

Explanation of the Effect.—The most commonly accepted explanation is that the tree roots suffer from the competition of the strong and widely searching grass roots, in obtaining moisture and plant food, particularly the former. The writers of the report are, however, unable to accept this solution, and give full accounts of experiments designed to test it.

Their findings and arguments may be summarised as follows:—

1. The effect of grass is pronounced in wet seasons as well as in dry ones.

2. Trees which are affected show none of the characteristic signs of suffering from drought; and, in fact, in a time of drought the grass shows the effect much sooner than the trees.

3. The difference between the foliage of trees grown on cultivated soils and that of those grown on grass is most marked in autumn and spring, when there is plenty of moisture in the soil.

4. Determinations of the water content of soils, in which trees were suffering from the effect of grass, did not show lack of moisture as compared with cultivated soils; in fact, rather the reverse.

5. Affected trees artificially watered still continued to show the effect of the grass, even when the grass roots were prevented from coming into contact with those of the tree.

6. Extra manuring to affected trees did not do away with the effect of grass, which also was just as marked when the crop was grazed by goats as when mown and left on the surface, as was ordinarily done.

The effect of aeration of the soil was also insufficient to account for the better thriving of the trees grown on cultivated soil, and in the same way there was no evidence to suggest an alteration in the physical condition of the soil or a change in the character of the soil bacteria sufficient to account for the effect.

Partly as a result of experiments designed to test the point directly, and also partly as a result of eliminating all other possible explanations, the authors conclude that in the growth of the grass a substance toxic to the roots of trees is formed. This substance, however, easily oxidises, and if the grass is killed or removed, the trees soon recover from its effect, and are actually benefited by grass leachings in cases where these have been exposed to air.

LIVE STOCK AND FEEDING STUFFS.

Feeding Experiments with Cattle and Sheep (*Northumberland C.C. Educ. Com., Bull.* 17, *Cockle Park Expt. Sta.*).—This bulletin gives accounts of several different feeding experiments carried out at Cockle Park in 1910–11. The results may be summarised in the following form :—

1. *Testing of Feeding Standards.*—Two lots of cattle were fed on rations exactly the same, except that one received 6 lb. soya cake (or decorticated cotton cake) per head per diem, while the other lot were given 4 lb. of soya cake (or decorticated cotton cake) and 2 lb. Bombay cotton cake. The latter, along with 80 lb. swedes, 8 lb. meadow hay, and 8 lb. oat straw, per 1,000 lb. live weight of the animal, corresponded to the Wolff-Lehmann standard, while the former provided a larger proportion of digestible albuminoids.

The cattle receiving the richer ration increased during the four months' experimental period at a rate of $13\frac{3}{4}$ lb. per head weekly, as compared with $13\frac{1}{4}$ lb. in the case of the other lot. Owing, however, to the greater cost of the former ration the cattle were fed on it at a slight loss, while the others on the cheaper ration, with less albuminoids, gave a slight profit.

2. *Comparison of Decorticated Cotton Cake and Soya Cake.*—The analyses of the two cakes were very similar, but the cost of the cotton cake was £8 10*s.* per ton, against £6 12*s.* 6*d.* for the soya cake.

When tried with two lots of fattening bullocks the average gain per head in the lot receiving decorticated cotton cake was 14 lb. weekly, while in the lot receiving soya cake it was 13 lb. The greater cost of the former food, however, more than neutralised this difference, and while the use of soya cake resulted in a gain of 2*s.* 8*d.* per head, decorticated cotton cake gave a loss of 2*s.* 6*d.* per head. This confirms the results of previous trials, which have shown "that these two cakes have a very similar value for feeding purposes."

With stirks six months old the financial returns were slightly in favour of the decorticated cotton cake.

3. *Feeding Sheep without Swedes.*—In this experiment "three-parts

bred" hoggs were fed indoors in two lots, one receiving a ration containing 10 lb. swedes a day, while in the other swedes were replaced by $\frac{7}{8}$ lb. maize meal and 1 lb. oat straw. The lot receiving swedes increased at the rate of 1·06 lb. per head weekly, the others at the rate of 1·22 lb. Owing, however, to the greater cost of the second ration, the financial results were practically the same for the two lots.

4. *The Feeding Value of Digestible Albuminoids and Amides.*—From an experiment designed to test the feeding value of amides, it is concluded that the flesh-forming value of amides is negligible, but that for all practical purposes the digestible total albuminoids (which includes amides) may be taken in calculating rations.

DAIRYING.

Milking Machine Trials (*Midland Agric. and Dairy Coll., Bull.* 1, 1911–12).—In 1909 and 1911 trials with a well-known milking machine of the suction type were carried out to test its efficiency, to see if machine-milked cows become "dry" sooner than hand-milked ones, and to observe the effect of the system of milking on the chemical composition and on the purity, from a bacteriological point of view, of the milk.

In each year one group of cows was milked as completely as possible by machine, and then stripped by hand (it was found impossible to reduce the strippings to less than $1\frac{1}{2}$ to 2 lb. from a cow yielding 20 lb. of milk); the other group was milked entirely by hand. In 1909 the average fall over a period of ten weeks in the milk yield of machine-milked cows was 26 lb. a week, as compared with 21·6 lb. a week in the case of hand-milked cows. In 1911 it was not possible to prolong the test for more than four weeks, and in this period the average weekly decline in the yield of milk given by the two groups of cows was the same.

As regards the fat content of the milk, there was practically no difference between that obtained by the two systems, though it must be remembered the cows were stripped by hand after the machine.

To test the cleanliness of the milk obtained in the two ways separate cheeses were made, and also direct bacteriological examination was carried out. In the first season, when the machine was run without special care and under conditions similar to those which would obtain on an ordinary farm, the milk was often of a bad flavour, and unless special precautions were taken in making, the resulting cheese was inferior in flavour and quality. In the second series of trials the machine was placed under the charge of a skilled person, and special measures, such as soaking the teat-cups in various solutions, were adopted to keep the important parts clean. As a result of this there was a marked improvement in the cleanliness of the milk, and cheeses with a better flavour than before were obtained.

It was found that the number of bacteria in machine-drawn milk was greater than in the hand-drawn milk. A curious feature of the machine-drawn milk was that, though it contained sometimes as many as ten times the number of bacteria in hand-drawn milk, it took longer to ripen. It is pointed out that the total number of bacteria present in milk was not by itself a reliable guide, as many of the organisms had no action on milk.

The chief disadvantages of the machine appeared to be the great difficulty of keeping various parts of the machine in a suitably clean state, and the apparent impossibility of preventing the teat-cups falling off during the milking, with resulting loss of time and contamination of the milk.

MISCELLANEOUS.

The Food of the Starling (*Second Report on Economic Biology, by W. E. Collinge,* 1912).—146 starlings were shot in the vicinity of Birmingham from January to June, 1911, and the contents of their stomachs examined. Details of the results are given, from which it is clear that the food of the birds had been of a distinctly insectivorous nature, and in hardly a single case was there any grain or other farm or garden crops. It is, however, pointed out that the results might have been different if the birds had been shot in a purely agricultural district, and that in order to make the investigation complete, it should have been continued over the whole year, when information as to the extent to which starlings inflict loss on fruit-growers would have been obtained.

OFFICIAL NOTICES AND CIRCULARS.

Advisory Committee on the Development of Forestry.

The Right Hon. Walter Runciman, M.P., President of the Board of Agriculture and Fisheries, has appointed a Committee to advise the Board on matters relating to the development of forestry. References will be made to the Committee from time to time as occasion arises. The Committee will be asked in the first instance :—

(1) To consider and advise upon proposals for a Forestry Survey;

(2) To draw up plans for experiments in sylviculture, and to report upon questions relating to the selection and laying out of forestal demonstration areas;

(3) To advise as to the provision required for the instruction of woodmen.

The Committee is constituted as follows: Sir Stafford Howard, K.C.B. (Chairman); Mr. F. D. Williams-Drummond; Sir S. Eardley-Wilmot, K.C.I.E.; The Right Hon. R. C. Munro-Ferguson, M.P.; Lieut.-Col. D. Prain, C.M.G., C.I.E., F.R.S.; Mr. E. R. Pratt, President of the Royal English Arboricultural Society; Professor Sir W. Schlich, K.C.I.E., F.R.S.; Professor Wm. Somerville, D.Sc.; The Hon. Arthur L. Stanley.

Mr. R. L. Robinson, of the Board of Agriculture and Fisheries, will act as Secretary.

Departmental Committee on Buildings for Small Holdings.

The Right Hon. Walter Runciman, M.P., President of the Board of Agriculture and Fisheries, has appointed a Departmental Committee to inquire and report as to the probable duration of the various classes and descriptions of buildings and other works required for the equipment and adaptation of land for small holdings in the various districts of England and Wales.

The Committee is constituted as follows :—The Hon. E. G. Strutt (Chairman); Mr. M. T. Baines, Senior Small Holdings Commis-

sioner; Mr. A. Barker; Mr. H. H. Law, M.Inst.C.E., Deputy-Chief Engineering Inspector of the Local Government Board; Mr. W. H. Ralston.

Mr. S. Samson, of the Board of Agriculture and Fisheries, will act as Secretary.

Departmental Committee on Small Holdings (Cheaper Buildings).

The Right Hon. Walter Runciman, M.P., President of the Board of Agriculture and Fisheries, has appointed a Departmental Committee :—

1. To inquire and report as to the nature and character of the buildings which should be provided for use in connection with small agricultural holdings in England and Wales, regard being had :—

(*a*) To the convenience and requirements of the occupiers.

(*b*) To considerations of economy, and also the possibility of the reduction of cost by the use of materials and methods of construction different from those ordinarily employed at present;

(*c*) To the special agricultural and building conditions of the different parts of the country; and

(*d*) To the various requirements of the Public Health Acts, and any Orders or Regulations made thereunder.

2. To submit a series of plans and specifications likely to be of assistance to local authorities and landowners for the purpose.

The Committee is constituted as follows :—Mr. Christopher Turnor (Chairman); Mr. Colin Campbell; Mr. E. J. Cheney, an Assistant Secretary to the Board of Agriculture and Fisheries; Mr. F. R. Harding-Newman; Mr. Cecil Harmsworth, M.P.; Mr. A. Ainsworth Hunt, M.S.A.; Mr. H. H. Law, M.Inst.C.E., Deputy-Chief Engineering Inspector of the Local Government Board; Mr. Henry T. Tate; Mr. Raymond Unwin.

Mr. C. W. Sabin, of the Board of Agriculture and Fisheries, will act as Secretary.

Committee on Mountain and Moorland Breeds of Ponies.

The following gentlemen have consented, on the invitation of the President of the Board of Agriculture and Fisheries, to act as a Committee to advise him as to whether, and, if so, what measures can be adopted for the improvement of mountain and moorland breeds of ponies :—

Lord Arthur Cecil; Mr. C. Coltman Rogers, Mr. T. F. Dale, Mr. A. C. Mardon, and Mr. E. P. Worthey.

Mr. A. B. Charlton, of the Hunters' Improvement Society, will act as Secretary.

American Gooseberry Mildew Notice Forms.

The Board of Agriculture and Fisheries have made arrangements with the Controller of his Majesty's Stationery Office whereby books containing one hundred of either Form A $\frac{150}{1}$ declaring certain premises to be "infected premises," or Form A $\frac{151}{1}$ requiring the occupier of infected premises to take steps to remove visible traces of disease, can be obtained by Local Authorities

for the use of inspectors under the Destructive Insects and Pests Acts, 1877 and 1907, in connection with the administration of the American Gooseberry Mildew Order, 1911.

The price of the books is one shilling, post free. Applications for them should be addressed to Messrs. A. and E. Walter, Ltd., of 13–17, Tabernacle Street, London, E.C.

The Board trust that Local Authorities will find it convenient to use these books so as to secure uniformity of practice.

Tomato and Cucumber Canker.

The Board of Agriculture and Fisheries desire to warn all growers of tomatoes that the disease known as Tomato and Cucumber Canker (*Mycosphærella citrullina*) is included among the diseases which, in pursuance of the Destructive Insects and Pests Order of 1910, must be reported to the Board by the occupier of any premises on which they appear. A description of the disease is given in the Board's leaflet, No. 230, copies of which can be obtained free of charge, and post free, on application to The Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W. Letters so addressed need not be stamped.

Growers who are in doubt as to whether or not the disease is present on their premises should submit specimens of affected plants to the Board for determination.

Up to the present the disease has been chiefly confined to tomatoes grown under glass. Occupiers of premises on which the disease appeared last year are strongly advised not to plant tomatoes in the same soil, unless it has been adequately sterilised, and to spray all their plants during the early part of the season with Bordeaux mixture or a solution of liver of sulphur (one pound to 32 gallons of water).

Re-Allocation of Duties of H.M. Commissioners of Woods.

As announced in reply to a question asked in the House of Commons on February 20th, 1912, Sir E. Stafford Howard has tendered his resignation of the office of one of the Commissioners of His Majesty's Woods and Forests. His resignation will take effect as from March 31st next. No new appointment of a Commissioner will be made to fill the office he vacates, and there will be a fresh allocation of the Commissioners' duties between the two remaining Commissioners, Mr. Runciman, the President of the Board of Agriculture and Fisheries, and Mr. G. G. Leveson-Gower. The supervision of the Crown Forests other than Windsor and of the more important Crown Woods will now be committed to Mr. Runciman, with the object of bringing their administration into closer co-operation than has hitherto been possible with the work of the Board in regard to the development of sylviculture and forestry.

Importation of Animals, Hay and Straw into Ireland from Great Britain.

The Board of Agriculture and Fisheries gave notice on February 13th last that the Department of Agriculture and Technical Instruction for Ireland had decided in view of the satisfactory position of Great Britain in regard to Foot-and-Mouth Disease, that (1) importations into Ireland of ruminant animals and swine could be again allowed from any part of Great Britain, subject to the ordinary conditions applying in such cases; and (2) the restrictions on landing in Ireland of British-grown hay and straw need not further be maintained.

The Orders prohibiting the landing in Ireland of hay and straw from foreign countries in which Foot-and-Mouth Disease exists continue in force.

Produce of Crops in Great Britain.

Part II. of the Agricultural Statistics for 1911 [Cd. 6056, price 4½*d.*] has recently been issued by the Board, and contains the returns as to the yields of crops in Great Britain in 1911, compiled from the estimates furnished by the Board's Crop Reporters, together with summaries for the United Kingdom. Preliminary statements showing the estimated average yield per acre and total production of the various crops were issued for hops on October 12th; for corn, pulse, and hay on November 3rd; and for potatoes and roots on November 29th, 1911.

MISCELLANEOUS NOTES.

Notes on Agriculture Abroad.

Importation of Australian Mutton into Germany.—H.M. Vice-Consul at Leipzig (Mr. Turner) reports that, in connection with the high price of meat in Germany, the Butchers' Guild of Chemnitz recently made the experiment of importing a quantity of Australian mutton. A demonstration of the manner of cooking the mutton was given, and the meat was subsequently disposed of to the public at prices ranging from 75 pfennigs (9*d.*) to 65 pfennigs (8*d.*) a pound. It is believed that this experiment is the first of its kind in Germany. Should it seem likely that Australian meat could be satisfactorily disposed of in Germany, British houses interested in the industry might find it to their advantage to turn their attention to this market.

H.M. Vice-Consul is of opinion that opposition would probably be met with from the agricultural interests, and that difficulties would also be encountered both in accustoming the population to the use of frozen meat and in the provision of suitable storage facilities, especially during the summer months.

Potato Drying in Germany.—The problem of the proper utilisation of the surplus potato crop in Germany has been to some extent solved in recent years by the introduction of satisfactory methods of potato drying. In 1908 the total potato crop of Germany amounted to 915 million cwt., and of this it is estimated that about 256 million cwt. were used for

human consumption, 79 million cwt. in the starch and alcohol industries, 108 million cwt. for seed, and 374 million cwt. for feeding animals, leaving a surplus of 98 million cwt., valued at £6,000,000. The actual amount of the surplus naturally varies from year to year, according to the size of the crop, but the fact that the alcohol and starch factories had apparently reached their maximum production made it very necessary to find some profitable outlet for the surplus in order to avoid a decrease in the acreage. A further impulse was given to the potato drying industry in 1909 by the increased taxation of brandy, which, it is estimated, decreased the consumption of this spirit by 22 million gallons per annum.

Many systems of drying potatoes have been invented suitable for the manufacturer as well as the small farmer, but the methods generally in use produce either dried potato slices (*Kartoffelschnitzel* or *Kartoffelscheiben*) or dried potato flakes (*Kartoffelflocken*).

Experiments with these dried potato foods (see *Journal*, July, 1911, p. 332) have shown that they form an excellent feeding stuff for all kinds of stock, and may with advantage be used in preference to raw potatoes when the latter have sprouted or are otherwise of inferior quality. The price of these potato flakes is stated to be about 7*s.* or 8*s.* per cwt.

The following particulars relating to the statistics of potato drying in Germany are given in the *Mitt. der Fachberichterstatter des K.K. Ackerbauministeriums* (Austria) No. 1, 1912 :—

There were on July 1st, 1910, 257 potato-drying factories in Germany; 65 were owned co-operatively or by companies; steam drying apparatus was in use in 209 factories, and hot air in 45. Unskinned potatoes were mostly used, peeled potatoes forming the raw material of only eight factories.

During the year 6,546,000 cwt. of potatoes were dealt with. The dry products amounted to 1,723,000 cwt., including flakes 1,374,000 cwt., and slices 314,000 cwt. The total production in 1909–10 was almost double that of 1908–9. The industry is said to have had a steadying influence on prices by giving farmers an alternative market.

Estimated Export of Siberian Butter in 1912.—A memorandum by Mr. Cooke, Commercial Attaché to H.M. Embassy at St. Petersburg, states that, according to the official *Commercial Gazette* of St. Petersburg of February 14th, the export of butter from Siberia in 1912, as estimated by the Conference of Exporters meeting at Omsk on January 28th and 29th, will be about 72,400 tons, or 5 per cent. increase over the export in 1911. It is also estimated that about 82 per cent. of this total will be exported during the summer season.

Dry Farming in Russia.—The following account of dry farming as practised in Russia is taken from the report of H.M. Vice-Consul at Kharkoff :—

Large tracts of fertile soil in Russia lie in a semi-arid zone, where the rainfall between spring sowing and harvest is very small, and the excessive heat and winds rapidly dry the soil. The proper development of the grain largely depends upon the possibility of retaining the moisture in the soil or of drawing upon the reserve of water below the surface.

A method in use in the United States (named after its inventor, Professor Campbell) is being largely adopted in such districts. It consists in deep (say 10 in. or more) ploughing, in pressing down the lower surface of the furrow by means of a special type of wheeled roller or "subsoil packer" to increase the capillary action from the damp earth towards the roots of the grain. Both immediately after ploughing, and as long as possible after sowing, the surface is kept in a pulverised state by means of harrows and cultivators, so as to stop the capillary action near the surface and thus to retard evaporation. The grain is sown in rows, about 7 in. apart, so as to facilitate the cultivation of the soil between the rows during the early part of the summer. Sometimes the rows are sown in narrow, 4-in. pairs, with 14 in. space between the pairs, for cultivation. Much less seed grain is thus used, and the grain is stronger and more abundant than with the usual method of sowing, and well repays the extra labour. Special machines for this system of cultivation are finding an increasing sale.

A simplified method more easily carried out by the poorer peasants, if the five years' rotation of crops is adopted, is the ploughing down of the stubble immediately after the harvest, or in early spring, and of keeping the fallow "black," viz., with pulverised surface and free of weeds. Stubble gives the necessary grazing land, but favours the growth of weeds and withdraws moisture and strength from the soil. For keeping a "black" fallow the peasants must, therefore, provide special land for sowing green fodder, which is possible in the five years' rotation of crops.

Another method, that has, however, not generally given satisfactory results, has been developed by Mr. Demtschinsky. He adopts the Chinese practice of transplanting the young grain and setting it deeper into the soil in order to get two or three successive rows of roots to develop out of the knots in the stem. In test cultures the results are stupendous, each seed producing a bush-like bunch of stems and widespread strong roots; but in practice, where instead of setting the plants deeper the earth is heaped on to the young stems, it is generally found that the work is ill spent. Special sowing machines are manufactured for this method of planting, but they have rarely been used, and only for experimental purposes. (*F.O. Repts., Annual Series,* No. 4781.)

Improvement of Agriculture in Russia.—Reports by H.M. Vice-Consuls at Nicolaiev and Kharkoff (*F.O. Reports, Annual Series,* No. 4781) call attention to the improvement of agriculture in Russia, which is resulting from the policy of the Russian Government in regard to land.

As a consequence of the new land policy, commenced in 1906, large areas of land have passed, and will continue to pass, into the hands of peasant proprietors. To this end financial aid on easy terms is given by the Peasant Land Bank. A further step in this policy is the alteration from the old system of tenure amongst the peasants, namely, that of tenure in common with a triennial redistribution of the communal land. A peasant can now hold his land in perpetuity, to the encouragement of better cultivation. Under the former system of common tenure the insecurity of tenure discouraged the peasants from any attempt at intensive cultivation. Another evil incident to the old system was the waste of time caused by all the peasants of a commune

living in one village. The villages were in consequence large, and the distances between them very great and devoid of dwellings. For those peasants whose holdings were situated at a distance from the village the time thus wasted in going to and from their work was enormous.

This drawback is now disappearing, and the face of the country is gradually undergoing a change. With the peasant secured in his tenure, he is beginning to live on his holding, and between the large parent villages houses may now be seen dotted over the steppe. Thus not only is time economised, but also, with the owner on the spot, more constant care is possible, and the subsidiary occupations of a farm life are to a much greater degree open to the wife and family.

The advantages of this change are obvious, and its effects, in conjunction with those of the institution of the small proprietors created with the aid of the land banks, far reaching.

Another factor in the new policy is the existence of a body of agricultural experts, stationed throughout the country under the supervision of the Zemstvos—the equivalent of our county councils—to advise and counsel the peasants and farmer on all matters of cultivation. The Zemstvos also maintain experimental farms where the peasants see the concrete results of better farming and of better seed grain. Seed is now sold by the Zemstvos where formerly the peasants used their own inferior grain for seed. Seed-cleaning and sorting machines are supplied to villages on hire. Lectures, frequently with limelight pictures, teach peasants how to increase the yield of their farms, show them the advantages of the five years' rotation of crops instead of the wasteful three years' rotation of winter grain, oats, and fallow, and teach them the use of better types of implements and the proper cultivation of the soil.

Government aid is also given in the shape of credits furnished to groups of peasants, on the joint responsibility of the group. Amongst the functions of these small credit associations is the advancing of cash against grain, for the purchase of implements, seed grain, and other requisites. These credit associations are gradually extending the scope of their functions, and in many villages stores have been opened. At these stores all the requisites of a peasant's existence can be procured, so that he is now no longer obliged to go into the towns for every small purchase.

The Imperial Bank has of late also adopted a new policy, and now participates actively in the realisation of the crops. Advances on grain are granted at 4½ per cent., which is for Russia an extremely low rate. A question at present being considered by the bank is the establishment of granaries at various centres. One effect of this new policy of the Imperial Bank, in so far as it regards the advances on grain, has been to make the Russian peasant a speculator on the world's grain market. Placed in a position of being able to obtain cash advances on his grain at 4½ per cent., the peasant frequently refuses to sell except at his own price. To what extent he will prove himself a wise speculator is a moot question. Much will depend on his ability to take a comprehensive survey of the world's supply and demand.

In this connection mention should not be omitted of the greater knowledge possessed now by the peasant of the world's daily prices,

to which the extension of the telegraphic system has greatly contributed. Another step in this direction was taken by the Government during the past year, when it was decided to post up every few days in all railway stations and public places frequented by peasants an official list of the prices prevailing for grain at the various large centres.

Notes on the Weather in February.

The weather during the *first* week of February (January 28th to February 3rd) was very wintry, but snow was seldom experienced except in the north-east and north of Britain. Temperature was much below the average, the deficit amounting to 10° in the south-west of England and the midland counties, and to about 9° in several other parts of Britain. Rainfall was as a rule "very light," but "moderate" falls were recorded in England E. and N.E., and Scotland E. An abundance of bright sunshine was experienced during the week all over the country.

At the beginning of the *second* week the general condition was again very wintry, and snow showers were experienced in almost all districts. After Monday in this week, however, a thaw extended over the country from the southward, the air became humid, and rain alternating with occasional bright intervals was experienced everywhere. Over the whole week temperature was below the average, but rainfall did not differ greatly from the normal. Bright sunshine was less than the average, except in Scotland N. and England N.W.

Throughout the *third* week, the sky as a general rule was either very cloudy or entirely overcast, while on several days small or moderate amounts of rain were experienced. "Unusual" warmth was experienced in England E., S.E., N.W., and the midland counties, and "moderate" warmth elsewhere. Rainfall was "moderate," and sunshine either "scanty" or "very scanty," except in Scotland N.

The weather throughout the *fourth* week was again very cloudy or overcast, while on most days there was more or less rain. Warmth was everywhere "unusual," the excess above the average being as much as 7° in England E. and the midland counties. Rainfall was more than the average in all districts except England N.W., the excess being very considerable in the west and north. Sunshine as a rule was "scanty" or "very scanty," but was "moderate" in England N.W. and N.E., and Scotland W.

The general condition continued very unsettled in the *fifth* week (February 25th to March 2nd), and slight or moderate falls of rain occurred on most days. In the extreme north and north-west, however, the rain was sometimes heavy locally. In the eastern districts of England and Scotland the falls were either "moderate" or "light." "Very unusual" temperature was recorded everywhere, the excess above the average amounting to 10° in the east of England. Bright sunshine was less than the normal in all districts.

Agricultural Conditions in Great Britain in February.

The Crop Reporters of the Board, in reporting on agricultural conditions during February, state that the mild, though generally wet, weather that prevailed after the first few days of the month, has been favourable to the winter crops, which are mostly looking vigorous and are well forward. The severe frosts during the first week, however, appear to have done damage in some districts, notably in the midlands, where both winter oats and beans suffered. A few cases are also mentioned where some re-sowing will have to be done owing to low-lying land having been flooded.

The rather persistent wet weather has nearly everywhere kept the land in a moist condition, and comparatively little progress has accordingly been made with spring sowings.

The lambing reports are not quite so unsatisfactory as last month, and it would appear that the earliest flocks have given the poorest results. In the midland and eastern counties, so far as lambing has taken place, the fall is, upon the whole, not more than average, but reports state that the lambs are healthy and more numerous than was the case last month, though cases of loss are frequently mentioned. Towards the north of England, where lambing had only just begun, reports are better; but in Scotland the very few lambings reported have been disappointing.

In certain districts sheep have suffered somewhat from the sharp weather in the early part of February, and losses of hoggs are recorded from the midlands; but stock began to show improvement towards the end of the month, although they are generally bare of flesh and backward in condition. The mild weather has allowed of their being turned out, and a further saving of the scanty stores of roots has consequently been effected. Turnips which had not been stored were in many cases damaged by the frosts at the beginning of the month.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for February, 1912, issued by the International Institute of Agriculture, shows that, after the inclusion of the latest harvest figures for Norway, Sweden, and Canada, which were published in the January bulletin, the total production of *wheat* in 1911 for the following countries in the northern hemisphere:—*Europe (excluding Portugal and countries south of the Danube other than Bulgaria); Canada, the United States; India, Japan, Asiatic Russia; Algeria, Egypt, and Tunis,* amounts to 394,184,000 qr., as compared with 398,084,000 qr. in the previous year, a reduction of 1 per cent.

If to this total be added the production in the four countries of the southern hemisphere, *Argentina, Chili, Australia, and New Zealand,* for which figures are available, the total production amounts to 430,547,000 qr., as compared with 432,551,000 qr. in the previous year, or a reduction of ½ per cent.

Sowing of Winter Cereals.—The areas estimated to have been sown with *wheat* up to December 31st, 1911, compared with the areas sown during the corresponding period of 1910, expressed as percentages, are shown for the following countries, in addition to those

for which similar information was published in the previous month :—Hungary (not including Croatia and Slavonia) 106; Croatia and Slavonia, 105; Roumania, 104·1; Japan, 102. The areas sown with *rye* are for Hungary, including Croatia and Slavonia, 102; Roumania, 87·7. The areas sown with *barley* are for Hungary, 103; Croatia and Slavonia, 104; Roumania, 73·9; and Japan, 99.

In Europe generally the condition of the winter corn was very good. An excess of rain has caused some damage to cereal crops in the north of *Italy*, while in some other parts of that country development has been retarded by lack of moisture. Very cold weather prevailed at the close of January and in the first part of February in several countries, and in *Sweden* the winter has been extremely cold, but no harm appears to have been done to the crops. In *Canada* intense cold was prevailing on February 1st, but the crops should not suffer, having a good covering of snow. The condition of winter wheat in *Japan* is reported at about average. Winter crops generally in *Tunis* are in good condition, while in *Egypt* the condition of barley seedlings is reported as good and of wheat average.

India.—The second official crop report for the United Provinces states that wheat prospects are uniformly favourable, and if the crop escapes rust, which has appeared in places, an excellent harvest is assured. The second official report for the Province of Bengal estimates the wheat area at 1,340,000 acres, compared with 1,382,000 last year. District officers estimate the yield at 97 per cent. of normal, but in view of the favourable weather, the out-turn is expected to be normal.—(*Broomhall's Corn Trade News*, March 4th and 6th.)

United States.—The *Cincinnati Price Current*, in its weekly report, states that the wheat crop, with few exceptions, is maintaining the promising outlook. The position in the west and south-west is favourable, particularly in Kansas.—(*Dornbusch*, March 8th.)

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on March 1st, 1912, certain diseases of animals existed in the countries specified :—

Austria (for the period February 14th—21st).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 2,115 Höfe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period January 16th—31st).

Anthrax, Blackleg, Foot-and-Mouth Disease (62 "foyers" in 49 "communes"), Rabies, Sheep-scab.

Bulgaria (for the period January 29th—February 6th).

Anthrax, Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Denmark (month of January).

Anthrax, Foot-and-Mouth Disease (251 cases), Swine Erysipelas.

France (month of December).

Anthrax, Blackleg, Foot-and-Mouth Disease (5,954 "étables" in 2,110 "communes"), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (*for the period February 1st—15th*).
Foot-and-Mouth Disease (4,790 infected places in 2,076 parishes), Glanders and Farcy, Swine Fever.

Holland (*month of January*).
Anthrax, Foot-and-Mouth Disease (75 outbreaks in 11 provinces), Foot-rot, Rabies, Swine Erysipelas.

Hungary (*for the period February 7th—14th*).
Anthrax, Foot-and-Mouth Disease (total of 111 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (*for the period January 15th—21st*).
Anthrax, Blackleg, Foot-and-Mouth Disease (117 new cases entailing 2,941 animals), Glanders and Farcy, Sheep-scab, Swine Fever.

Montenegro (*for the period January 1st—15th*).
Foot-and-Mouth Disease (20 "étables" infected in 8 "communes").

Norway (*month of January*).
Anthrax, Blackleg, Swine Fever.

Roumania (*for the period January 29th—February 5th*).
Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Russia (*month of October*).
Anthrax, Foot-and-Mouth Disease (121,266 animals in 2,446 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (*for the period January 27th—February 3rd*).
Foot-and-Mouth Disease (50 animals in 1 "commune"), Rabies.

Spain (*month of December*).
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (118,532 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (*month of January*).
Anthrax, Blackleg, Swine Fever.

Switzerland (*for the period February 12th—18th*).
Anthrax, Blackleg, Foot-and-Mouth Disease (111 "étables" entailing 1,371 animals, of which 20 "étables" were declared during the period), Swine Fever.

Agricultural Labour in England during February.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in February:—

Outdoor employment was somewhat interrupted by unfavourable weather during February, particularly in the early part of the month. Apart from such interruption, extra labourers, though in excess of requirements in several districts, were generally in fair demand for the time of year for such work as threshing, hedging, and ditching, carting and spreading manure. There was some scarcity of men for permanent situations in parts of the Midland and Southern and South-Western Counties.

Northern Counties.—Some time was lost by extra labourers at the beginning of the month on account of bad weather. There was otherwise, in many districts, a moderately good demand for such men to thresh, cart manure, clean ditches, and mend fences. In *Northumberland* and *Durham,* however, the demand was generally but small. Such men were in excess of the demand in the Penrith (*Cumberland*), West Ward (*Westmorland*), Bridlington, Driffield, Howden, and Sherburn (*Yorkshire*) Rural Districts. The usual Candlemas hiring fairs took place in *Cumberland,* but no general change in wages was reported in this county.

Midland Counties.—Extra men were principally employed at threshing, hedging, ditching, and spreading manure. Frost and rain hindered work somewhat in the early part of the month, but generally the demand for such men was fair for the time of year; some excess in the supply was reported in the Tamworth (*Staffordshire*), Evesham, Shipston-on-Stour, and Upton-on-Severn (*Worcestershire*), and Buckingham Rural Districts. Some scarcity of men for permanent situations was reported in the Leek, Lichfield, and Uttoxeter (*Staffordshire*), Banbury (*Oxfordshire*), and Wing and Wycombe (*Buckinghamshire*) Rural Districts.

Eastern Counties.—There was, on the whole, a fairly good demand for extra labourers in these counties. With the exception of a few days at the beginning of the month, but little time was lost by such men through bad weather. The demand was again reported as adversely affected by the failure of the root crops in *Norfolk* and *Suffolk*. There was some surplus in the supply of such men in the Downham (*Norfolk*), and Cosford, Mutford and Lothingland, and Thingoe (*Suffolk*) Rural Districts. The supply was said to be somewhat short in the Chesterton (*Cambridgeshire*) and Orsett and Rochford (*Essex*) Rural Districts. No general change in wages was reported at the Candlemas hiring fairs held in *Lincolnshire.*

Southern and South-Western Counties.—Rain or frost caused some irregularity in the employment of extra labourers in most districts. When the weather permitted, there was generally a fair demand for these men for such work as threshing, hedging, ditching, and manuring land. There was a plentiful supply of such men, and some excess was reported in the Elham (*Kent*), Epsom and Farnham (*Surrey*), Hartley Wintney (*Hampshire*), and the Cricklade and Wootton Bassett and Devizes (*Wiltshire*) Rural Districts. A scarcity of men for permanent situations was reported in several districts, including the Godstone (*Surrey*), Petworth (*Sussex*), Blandford (*Dorset*), Dursley, and Stow-on-the-Wold (*Gloucestershire*), Axminster and Kingsbridge (*Devon*), and Truro (*Cornwall*) Rural Districts.

THE CORN MARKETS IN FEBRUARY.

C. KAINS-JACKSON.

Wheat.—The month of February saw the advancing tendency in wheat first emphasised, and increased by severe cold, then arrested by a change to springlike weather, and finally converted into a movement more or less in buyers' favour. The period has been one of

"weather markets" throughout. This has been due to the statistical situation not being especially helpful either to purchaser or vendor. In such a case the weather may be said to exercise a casting vote. The shipping countries have been watched with much interest, but the indication obtained from this source has been indefinite.

Argentina, for example, only shipped 621,000 qr., against 1,250,000 qr. and 1,328,000 qr. in the two preceding Februarys, but then the railway strikes kept back up-country supplies during three weeks, and the export of 330,000 qr. in the first week of resumed traffic to the coast argued that but for a non-agricultural element of disturbance the month's exports would have fully equalled the figures of 1911 and 1910. The small shipments from Russia, 412,000 qr., were balanced by North America shipping 769,000 qr., against 390,000 qr. in February, 1911, while if India had been expected to ship more than 307,000 qr., Australia had not been credited with ability to send off 705,000 qr. out of a crop which the International Institute had warned us not to regard as an average one. Europe S.E. for February shipped 538,000 qr., but only 65,000 qr. of this total is covered by British bills of lading. When Europe S.E. ships heavily in any given month, but almost exclusively to ports other than British, the effect is apt to be registered on our markets a full month later in the form of increased pressure to sell to Great Britain on the part of Argentina, the United States, and India, countries which, but for the shipments from South-Eastern Europe, would have had outlets in France, Italy, Spain, and the Low Countries. By reason of contiguity, Germany continues mainly to buy of Russia, and Australia from the very beginning has practically relied upon placing her entire wheat surplus with British buyers. One reason for this is to be found in the strong likeness between British and Australian wheat in loaf-making.

With February 29th ended the first half of the cereal year, for which the total wheat shipments were found to be, from North America, 6,247,000 qr.; from South America, 1,956,000 qr.; from Russia, 5,044,000 qr.; from Europe S.E., 5,539,000 qr. (Europe S.E. surpassing Russia is remarkable); from India, 2,191,000 qr.; from Australasia, 2,893,000 qr.; in all, 23,870,000 qr. This total is below the average.

The British wheat average for February showed some advance on January, reaction in wheat prices towards the close of the month being mainly in La Plata, Australian, and ordinary Canadian kinds. The British average for the first half of the cereal year was 33*s.* per qr. Imports and home deliveries together give a total supply in excess of the estimated requirements by over a million quarters, but the stocks in the fifteen chief ports were, at the end of February, less than usual. There are now 3,300,000 qr. of wheat on passage, a quantity virtually identical with the expectations of a year ago. February closed with ordinary Canadian wheat (type No. 4 Manitoba) at 40*s.*, with Australian at 39*s.* 6*d.*, with choice white Indian at 39*s.* 3*d.*, all per quarter. American red winter was fetching 7*s.* 10*d.* per cental.

Flour.—The month in this trade was remarkable for a rise of 2*s.* in the top-price, which had stood at 32*s.* net for some months, but rose to 33*s.* on the 12th, and to 34*s.* on the 28th. Town Households advanced from 28*s.* on January 29th to 29*s.* on February 12th, but no further advance was effected. Most of the London bakers advanced

the price of bread a halfpenny in the course of the month, but during the last half of February millers complained that bakers were buying less freely than usual. Prices made on the 28th for imported flour included 32*s.* for the finest North-Western Patents; 30*s.* for First Minnesota; 26*s.* 6*d.* for Common Kansas (made from winter wheat); 26*s.* for Australian; 25*s.* 3*d.* for Iron Duke; and 20*s.* to 21*s.* per qr. for feeding flour. The demand for this, whether the supply was from America or from France, was above the average. At the close of the month 181,000 sacks of flour were on passage. North American shipments for February were only 315,000 sacks.

Barley.—At Mark Lane's closing market for the month fine seed barley touched 39*s.* per 400 lb. corresponding to 43*s.* or 44*s.* per qr. of 448 lb. Chilian brewing made 35*s.* 6*d.* per qr. Californian was scarce and dear, and the best screened barley from Anatolia commanded 40*s.* Feeding barley declined in price after the 29th. Russian began the month at 28*s.* 9*d.* per 400 lb., and closed at 27*s.* 9*d.* Indian began at 27*s.* 9*d.* and closed at 26*s.* 6*d.* Some new crop barley for shipment from North Africa was mentioned at 25*s.* 3*d.*, while Indian new crop had speculative forward buyers at a 25*s.* level. Imports for the first half of the cereal year have been a good deal above the average, but owing to the dearness of hay and straw, the scarcity of roots, and the small imports of maize, inquiry has been above the mean, and February ended with very moderate granary stocks. There are only 300,000 qr. on passage, against 680,000 qr. a year ago. February shipments were 916,000 qr. from Russia, 339,000 qr. from Europe S.E., and 120,000 qr. from India. The last item is exceptionally large.

Oats.—English oats have commanded a decidedly high price, and there have been few markets at which anything of 336 lb. weight could be bought under 22*s.* The supplies have seldom been equal to requirements of heavy oats, but the inquiry for 304 lb. sorts and for those of a thick husk has fluctuated a good deal. The Argentine oats on passage, however, declined on 28th to 18*s.*, and the trade for the next two months is expected to be dominated by the efforts of La Plata to dispose of a large new crop. For March shipment the price on 29th was 17*s.* to 17*s.* 3*d.* per qr. only. Shipments of oats for February were 18,000 qr. from Canada (these oats fetch 22*s.* to 23*s.*), 480,000 qr. from Argentina, 543,000 qr. from Russia, and 50,000 qr. from Europe S.E. There are 460,000 qr., a good quantity, on passage.

Maize.—The imports of this cereal for February were below estimated requirements, and for the first half of the cereal year were estimated at one and a half to two million quarters less than current needs. The stocks are much reduced, and, as we have seen, there have been large purchases of feeding barley in lieu of maize. It is therefore curious that prices during February fell fully half a crown per quarter on Russian, a shilling on American, and on Indian two shillings. The cause is the expectation of record shipments of Argentine new crop in June and July, but the speculative market has seldom so dominated spot trade. February shipments were 795,000 qr. from North America, 403,000 qr. from Russia, 867,000 qr. from Europe S.E., and 50,000 qr. from India. There are 560,000 qr. on passage, against 495,000 qr. a year ago.

Oilseeds.—India in February shipped only 41,000 qr. of linseed, while Argentina's 203,000 qr. were much below anticipation, and on the last day of the month only 90,000 qr. were on passage to this country. Prices have therefore been but little reduced, and the best linseed cake has been costing farmers 11*s.* per cwt. This is 2*s.* per cwt. rise on the year. Lower prices are anticipated when Argentina has shipped a little more freely, and the Indian new crop is in motion. Decorticated cottonseed cake has had a brisk sale at 8*s.* 6*d.* per cwt.

Various.—Dari has been in larger demand than supply, so that 35*s.* has been about the lowest price accepted. Tares have remained as dear as ever—88*s.* per qr. for good winter. Russia has sent us a timely supply of buckwheat, which has sold well at 28*s.* per 416 lb. Beet sugar has risen to 16*s.* per cwt., and this despite augmented stocks. Rice has continued rather dear, and with only 18,000 tons on passage as compared with 32,000 tons a year previously, the feeling of holders at the close of the month was naturally confident.

THE LIVE AND DEAD MEAT TRADE IN FEBRUARY.

A. T. MATTHEWS.

Fat Cattle.—Trade in fat cattle was of a very even character. Not only was there very little change in average values from week to week, but prices varied much less than usual at the different markets. Supplies at the Metropolitan market were somewhat smaller than those of January, but maintained an average of nearly 1,000 head, the contingent from Ireland being again unusually large. The reason for these abnormal supplies of Irish bullocks is the want of a market for them in the autumn as stores. Norfolk feeders could not purchase so many as usual owing to the scarcity of winter fodder, and therefore they had to be fed at home. They are mostly Shorthorns in very fair condition, and are making well up to 8*s.* 9*d.* per stone.

The following average prices in the leading English markets show very little change from those of January, but, with the exception of Devons, such movements as there have been have shown a slight upward tendency. Shorthorns averaged 8*s.* 9*d.* for first, and 7*s.* 10*d.* for second quality, against 8*s.* 8*d.* and 7*s.* 9*d.* per stone; Hĕrefords, 8*s.* 11*d.* and 8*s.* 3*d.*, against 8*s.* 11*d.* and 8*s.* 3*d.*; Devons, 8*s.* 10*d.* and 8*s.*, against 9*s.* and 7*s.* 11*d.*; Welsh Runts, 8*s.* 9*d.* and 7*s.* 10*d.*, against 8*s.* 8*d.* and 7*s.* 10*d.*; and Polled Scots, 9*s.* and 8*s.* 4*d.*, against 9*s.* and 8*s.* 3*d.* per stone. The Scottish markets have been very firm, and for Shorthorns have averaged as high as those of the English. In the week ending February 22nd, Shorthorns in Scotland of first quality averaged 40*s.* 8*d.* per live cwt., against 40*s.* 4*d.* in England. It is also interesting to note that Polled Scots in the northern markets only exceeded the Shorthorn average by 1*s.* per live cwt., their average being 41*s.* 8*d.* per cwt.

Veal Calves.—These have been quoted officially in about twenty

British markets, and the trade has been of a similar character to that of January. The averages have worked out each week at 8½*d.* and 7½*d.* per lb. for first and second quality.

Fat Sheep.—The abnormal conditions ruling in the markets for sheep make it difficult to place on record the average prices realised for all classes. Thousands of tegs have been exposed in the London market alone during the past month in ordinary store condition, and have only found purchasers at extremely low prices. In fact, these have formed such a large proportion of the total supplies, that really good conditioned sheep have been difficult to find, and prices for fairly meated tegs have advanced since the middle of January as much as 1½ per lb., at any rate in the London market. On the third Monday the best small tegs freely fetched 9½*d.* per lb., and in a few extreme cases 9¾*d.*, while those weighing 80 lb. have easily made 9*d.* Many tegs have been sold at 60*s.*, and even more has been reported in the country. The scarcity of good British mutton has been long foreseen, and is likely to continue for several months. The average for first quality Downs in English markets in the third week was 8¾*d.* per lb., and 7¾*d.* for second quality, while fat ewes advanced to 6¼*d.* Longwools in the same week averaged 8¼*d.*, 7¼*d.*, and 5½*d.*, the average price of this breed in September last being 6¾*d.* for first quality. Fat lambs are coming out very sparingly, but are not meeting with a very good demand at present. Their condition, like that of the tegs, is very indifferent.

Fat Pigs.—Bacon pigs are gradually but steadily hardening in value, and averaged 6*s.* 6¼*d.* and 6*s.* per 14 lb. stone in about thirty British markets. This is an advance of 6*d.* per stone from the lowest point, which was touched in December.

Carcass Beef—British.—Scottish beef has been a very even trade throughout the month, the second being the weakest week, when prices went back 2*d.* per 8 lb. stone (the weight that is always quoted at the Central Market). The average values of the month were 4*s.* 9½*d.* and 4*s.* 7½*d.* for first and second quality short sides, and 4*s.* 6¼*d.* and 4*s.* 4*d.* for "long" or whole sides. The latter touched 4*s.* 8*d.* in the last week. English sides also made rather less than in January, their averages being 4*s.* 3¼*d.* and 4*s.* 1*d.* for first and second quality.

Port-Killed Beef.—Deptford-killed American was moderately supplied, and met a very good demand at 4*s.* 2¾*d.* and 4*s.* 1¼*d.* as the monthly average.

Chilled Beef.—After the second week there was a fall in hindquarters of Argentine chilled, but forequarters maintained January prices. The averages for the former were 3*s.* 4*d.* and 2*s.* 11½*d.* for first and second quality, and for the latter 2*s.* 4*d.* and 2*s.* 2*d.* per stone. There was no United States chilled beef worth quoting.

Frozen Beef.—The demand for frozen beef was steady, and prices showed a slight advance on those of the previous month, forequarters selling relatively well. Hindquarters made 2*s.* 7¾*d.* and 2*s.* 6*d.* as the average of first and second quality, and fores 2*s.* 0¼*d.* and 1*s.* 10¾*d.* per 8 lb. That from New Zealand fetches about 1*d.* per stone more than that from Argentina, and 2*d.* more than Australian at the present time.

Carcass Mutton—Fresh-Killed.—Fresh-killed mutton, after a long period of great depression, advanced in price in sympathy with the live-stock markets. Scotch mutton went up to 5*s.* 2*d.* per stone for prime small tegs, and 4*s.* 8*d.* for 6½ stone sheep, averaging 4*s.* 10*d.* and 4*s.* 5*d.* respectively for the month. English tegs averaged 4*s.* 3*d.* and 4*s.* for first and second quality. The advance in Scotch amounted to about 5*d.* per stone, or ⅝*d.* per lb. The season for Dutch mutton has quite closed.

British Lamb.—Circumstances have been very unfavourable for the production of early lamb, and supplies have been small, though quite sufficient for the demand, prices being about 6*s.* 8*d.* to 7*s.* 4*d.* per stone.

Frozen Mutton and Lamb.—There has been no scarcity of frozen mutton, and all descriptions have been cheap. New Zealand prime quality has remained at 2*s.* 10*d.* per stone, and Argentine and Australian at 2*s.* 4*d.* and 2*s.* 5*d.* An advance is looked for shortly in view of the higher value of fresh-killed. New Zealand lamb of the new season has met a good trade at 4*s.* to 4*s.* 4*d.* per 8 lb.

Veal.—There has been but a poor demand for veal, and the British carcasses have chiefly been of very rough quality. Prices have been much lower than in January, the average for prime English being 5*s.* 6*d.* per stone, or 8¼*d.* per lb., in Smithfield market.

Pork.—There have been full supplies of British pork at the London dead-meat markets, and trade has ruled quiet but firm at an average of 4*s.* 3*d.* and 3*s.* 10*d.* per stone.

THE PROVISION TRADE IN FEBRUARY.

HEDLEY STEVENS.

Bacon.—The chief feature of the trade in this article during February has been the steady advance in prices for long sides of all descriptions. The arrivals of this cut from Denmark have been heavier, or with the moderate arrivals from Canada, and the smaller supplies of English and Irish, prices would have been much higher. The labour unrest brought about slightly easier prices during the last few days of the month, grocers being afraid to stock a perishable article like bacon. All American meats have experienced a very small demand, and prices have favoured buyers, these remarks applying especially to hams of all descriptions.

The imports for January and February have been in excess of those for the first two months of either of the two preceding years, the increased quantity being mostly made up from Denmark and the United States of America. Although prices are high, we are several shillings below those current at the same time last year, and it is confidently expected that, with temporary setbacks, prices will advance from now onwards. The high prices of feed for the pigs in most countries are causing an advance in the cost of breeding for the curer. The arrivals of hogs on the American markets continue large, but it is generally anticipated that there will be a falling off in the quan-

tities early in March. The values of hogs at Chicago during the month ranged from $5.80 to $6.35, against $6.65 to $7.85 last year, and $8.10 to $9.35 two years ago.

The English curers still report a shortage in the quantity of bacon pigs obtainable, and consequently they are having to pay higher prices. These conditions are likely to become more acute as time goes on.

Cheese.—The trading throughout the month has been of a very disappointing nature, and prices show little, if any, changes. Although present values are many shillings above those current at the same time last year, it is generally expected that still higher prices will prevail during the next three months, on account of the small stocks at all points.

It is now estimated that the increase in the make of New Zealand cheese will be about 10 per cent. over last year. There is no accumulation of this description on spot, although the arrivals have been heavier. There will be practically no more cheese shipped from Canada, and there is nothing to come from the United States, the small stocks being required for home consumption.

At the end of the month the estimated stock of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) was 139,000 cheese, against 210,000 at the same time last year, and 221,000 two years ago. The stock of New Zealands was 16,200 crates in London and Bristol, against 32,000 at the same time last year.

The abnormally high prices of English cheese have curtailed the consumption, but holders of stock are firm, especially on high-grade lots.

Butter.—The demand has been quiet, with a tendency for prices to drop slightly, especially at the close of the month, but no doubt the somewhat restricted trade in many districts on account of the threatened coal strike has been the cause of this. It is generally anticipated that prices will remain around present levels for the next two months at least. The weather during the month has not been conducive to a good consumption, and at such extreme prices dealers naturally operate very cautiously. The most striking feature of the market has been the way in which importers have been able to make within 2*s.* of first-grade goods for all secondary quality butter, which in the ordinary course of events would be selling at from 5*s.* to 6*s.* under best.

Some of the latest advices from Australia speak of the very serious effect that the drought is having on the production in that country, especially in Queensland and New South Wales; in fact, is is reported that these two States are finding it necessary to buy their best-grade butter in Victoria. The arrivals from the Argentine, which have been fairly free, have made good prices, as the quality is reported to be very fine this year. The weather there has been very favourable for the production of butter.

Eggs.—The arrivals of foreign eggs have been extremely small; in fact, importers have at times been able to make almost any prices they cared to name, so great has been the scarcity of these cheaper grades. At the end of the month prices for English show signs of easing a little.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of February, 1912.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	England. First Quality.	England. Second Quality.	Scotland. First Quality.	Scotland. Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 0	8 4	41 8	38 3
Herefords	8 11	8 3	—	—
Shorthorns	8 9	7 10	40 8	37 6
Devons	8 10	8 0	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	8½	7½	9	7
Sheep:—				
Downs	8¾	7¾	—	—
Longwools	8¼	7	—	—
Cheviots	8¾	8	8¼	7¼
Blackfaced	8¾	7¾	7¾	6¾
Cross-breds	8½	7½	8½	7½
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	6 7	6 1	6 5	5 8
Porkers	7 2	6 8	6 11	6 2
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	21 10	17 16	23 7	18 8
,, —Calvers... ...	22 3	16 16	19 18	17 6
Other Breeds—In Milk ...	17 6	15 16	18 4	15 10
,, —Calvers ...	—	10 10	19 5	16 2
Calves for Rearing	2 1	1 11	2 19	2 4
Store Cattle:—				
Shorthorns—Yearlings ...	9 9	7 18	10 13	8 18
,, —Two-year-olds...	13 16	11 14	15 11	12 8
,, —Three-year-olds	17 2	15 11	16 11	14 3
Polled Scots—Two-year-olds	—	—	16 13	13 11
Herefords— ,,	14 8	12 19	—	—
Devons— ,,	14 11	13 3	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	36 8	29 6	—	—
Scotch Cross-breds ...	—	—	30 5	26 0
Store Pigs:—				
8 to 10 weeks old	14 4	11 0	18 1	14 3
12 to 16 weeks old	23 0	17 0	21 6	14 4

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of February, 1912

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Liverpool.	London.	Manchester.	Edinburgh.	Glasgow.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BEEF :—							
English	1st	59 0	58 6	59 6	56 6	59 0*	60 6*
	2nd	53 0	54 6	57 0	53 6	54 6*	58 0*
Cow and Bull ...	1st	49 6	47 6	48 0	50 0	49 6	49 6
	2nd	44 6	42 0	43 6	46 6	44 6	45 0
U.S.A. and Canadian :—							
Port Killed ...	1st	—	58 6	59 6	57 0	—	—
	2nd	—	54 6	57 6	53 6	—	47 0
Argentine Frozen—							
Hind Quarters...	1st	36 0	36 6	37 0	36 6	37 0	37 6
Fore ,, ...	1st	29 0	28 6	28 6	28 6	29 0	30 0
Argentine Chilled—							
Hind Quarters...	1st	45 6	44 0	46 0	44 6	46 0	46 0
Fore ,, ...	1st	32 0	31 6	33 0	31 6	33 6	34 0
Australian Frozen—							
Hind Quarters...	1st	35 0	34 0	37 0	34 0	—	34 6
Fore ,, ...	1st	29 6	26 0	28 0	26 0	—	28 0
VEAL :—							
British	1st	66 0	76 6	76 6	76 6	—	70 0
	2nd	56 0	68 6	66 6	69 6	—	—
Foreign	1st	—	—	76 6	—	77 0	68 6
MUTTON :—							
Scotch	1st	—	72 6	67 6	71 6	60 6	70 0
	2nd	—	68 0	62 0	67 0	52 6	53 6
English	1st	63 0	64 6	59 0	66 6	—	—
	2nd	56 6	59 0	55 6	61 6	—	—
Argentine Frozen ...	1st	34 6	34 6	33 6	34 6	35 0	33 6
Australian ,, ...	1st	32 6	32 0	32 0	32 0	—	32 6
New Zealand ,, ...	1st	—	—	40 0	—	—	—
LAMB :—							
British	1st	—	—	100 6	—	—	—
	2nd	—	—	91 0	—	—	—
New Zealand ...	1st	51 6	55 0	59 6	55 0	—	—
Australian	1st	45 6	42 0	45 0	42 0	—	40 0
Argentine	1st	42 6	42 0	41 6	42 0	42 6	40 0
PORK :—							
British	1st	59 6	61 6	59 0	61 0	55 0	57 6
	2nd	54 6	53 0	53 0	56 6	48 6	52 6
Foreign	1st	—	—	56 0	—	—	—

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1910, 1911 and 1912.

Weeks ended (*in* 1912).	WHEAT.						BARLEY.						OATS.					
	1910.		1911.		1912.		1910.		1911.		1912.		1910.		1911.		1912.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 6 ...	33	6	30	5	33	2	24	11	23	11	33	3	17	2	17	0	20	7
,, 13 ...	33	8	30	8	33	1	24	11	23	10	33	0	17	7	17	2	20	8
,, 20 ...	33	9	30	11	33	4	24	11	24	4	33	3	17	6	17	4	20	11
,, 27 ...	33	6	30	11	33	7	25	0	24	5	33	1	17	4	17	3	21	1
Feb. 3 ...	33	7	30	9	33	8	24	10	24	5	32	10	17	7	17	5	21	3
,, 10 ...	33	4	30	5	34	0	24	9	24	6	33	2	17	11	17	5	21	4
,, 17 ...	33	0	30	3	34	4	24	6	24	7	32	10	18	0	17	6	21	7
,, 24 ...	32	7	30	2	34	6	24	2	24	9	32	8	17	10	17	7	21	9
Mar. 2 ...	32	7	30	0	34	1	24	6	25	0	32	0	18	1	17	5	21	6
,, 9 ...	32	6	30	1	34	1	24	1	25	0	31	7	18	0	17	5	21	8
,, 16 ...	32	6	30	1			23	6	24	11			18	0	17	6		
,, 23 ...	32	9	30	2			23	7	25	0			17	11	17	5		
,, 30 ...	33	0	30	3			23	8	24	11			18	0	17	5		
Apl. 6 ...	33	6	30	4			23	1	24	7			17	11	17	7		
,, 13 ...	33	7	30	3			23	5	25	2			18	3	18	3		
,, 20 ...	33	7	30	4			23	0	25	5			18	3	17	10		
,, 27 ...	33	0	30	11			22	10	25	5			18	3	18	3		
May 4 ...	32	6	31	4			22	7	25	7			18	2	18	6		
,, 11 ...	32	1	31	8			22	0	25	1			18	1	19	0		
,, 18 ...	31	10	32	6			21	8	25	4			17	8	19	2		
,, 25 ...	31	3	32	8			21	4	25	0			17	10	19	5		
June 1 ...	30	2	32	5			21	8	24	10			17	10	19	5		
,, 8 ...	29	1	32	4			20	9	25	7			17	10	19	7		
,, 15 ...	29	0	32	3			18	11	23	11			18	0	19	8		
,, 22 ...	29	4	31	11			20	1	23	9			17	9	19	10		
,, 29 ...	29	9	31	10			19	11	24	5			17	7	19	9		
July 6 ...	30	4	32	1			19	5	25	10			17	4	19	9		
,, 13 ...	31	1	32	3			21	3	25	10			17	7	19	11		
,, 20 ...	31	11	32	5			19	9	24	3			17	5	19	5		
,, 27 ...	33	5	32	5			20	10	23	8			18	1	19	7		
Aug. 3 ...	33	9	32	0			20	5	24	4			18	3	18	2		
,, 10 ...	33	5	31	6			20	4	26	9			18	0	18	0		
,, 17 ...	32	11	31	6			20	11	27	8			17	11	17	10		
,, 24 ...	32	7	31	8			20	10	28	10			17	2	18	0		
,, 31 ...	32	2	31	7			22	10	28	4			17	2	18	3		
Sept. 7 ...	31	11	31	10			23	3	28	4			17	2	18	1		
,, 14 ...	30	11	32	0			24	3	29	0			16	6	18	5		
,, 21 ...	30	2	32	4			24	2	29	11			16	3	18	9		
,, 28 ...	30	1	32	6			24	4	30	5			16	4	19	1		
Oct. 5 ...	30	1	32	7			24	7	30	9			16	3	19	5		
,, 12 ...	30	2	32	9			25	1	31	0			16	2	19	10		
,, 19 ...	30	4	32	9			25	3	31	5			16	1	19	11		
,, 26 ...	30	4	33	1			25	4	31	7			16	2	20	6		
Nov. 2 ...	30	4	33	4			25	6	31	10			16	2	20	8		
,, 9 ...	29	11	33	4			25	4	32	7			15	11	20	11		
,, 16 ...	29	8	33	1			25	1	32	10			16	1	21	0		
,, 23 ...	29	11	33	0			24	10	33	5			16	4	20	10		
,, 30 ...	30	6	32	10			24	7	33	10			16	7	20	11		
Dec. 7 ...	30	9	32	9			24	3	34	0			16	9	20	9		
,, 14 ...	30	7	32	11			23	9	33	5			16	10	20	9		
,, 21 ...	30	7	32	9			23	10	33	5			16	9	20	8		
,, 28 ...	30	5	33	0			23	9	33	4			16	9	20	7		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

	WHEAT.		BARLEY.		OATS.	
	1911.	1912.	1911.	1912.	1911.	1912.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
France: January	46 11	44 4	26 3	28 8	21 6	22 9
February	46 11	45 9	26 6	29 4	21 11	23 2
Paris: January	48 3	46 11	26 2	28 8	22 9	23 5
February	47 5	47 4	25 7	29 0	23 6	24 7
Belgium: January	32 9	34 5	23 8	29 7	19 2	23 10
Germany: January	41 2	44 7	27 10	36 2	21 5	26 11
Berlin: January	43 2	45 3	—	—	20 11	27 0
Breslau: January	38 3	40 2	27 2* / 22 11†	32 10* / 28 0†	19 8	25 2

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of February, 1911 and 1912.

	WHEAT.		BARLEY.		OATS.	
	1911.	1912.	1911.	1912.	1911.	1912.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London...	31 7	35 2	24 3	33 4	18 7	23 4
Norwich	30 4	33 8	23 5	33 0	17 8	21 7
Peterborough	29 7	33 3	23 10	32 1	17 1	21 9
Lincoln...	29 10	33 3	24 11	32 0	17 4	21 4
Doncaster	29 8	33 5	24 7	31 10	16 11	20 10
Salisbury	29 9	34 1	23 9	34 8	17 4	21 9

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of February, 1912.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	18 0	16 0	—	—	17 3	15 9	17 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Factory	—	—	124 0	120 0	—	—	—	—
Danish ...	—	—	138 0	135 6	137 0	135 0	133 0	—
French ...	—	—	—	—	148 6	146 6	—	—
Russian ...	131 0	127 6	—	—	130 6	127 0	—	—
Australian ...	132 0	129 0	132 0	129 6	129 0	127 0	132 0	130 0
New Zealand	134 0	132 0	134 0	132 0	132 0	130 0	134 0	130 0
Argentine ...	131 6	130 0	131 6	129 6	129 0	126 6	131 6	—
CHEESE :—								
British—								
Cheddar ...	96 0	85 6	89 0	85 0	96 6	90 0	78 6	76 6
			120 lb.	120 lb.	120 lb.	120 lb.		
Cheshire ...	—	—	89 6	82 0	95 6	90 0	—	—
			per cwt.	per cwt.	per cwt.	per cwt.		
Canadian ...	75 0	74 0	74 6	73 0	76 0	74 6	76 0	74 0
BACON :—								
Irish	62 0	57 0	62 6	57 0	66 6	62 6	64 0	—
Canadian ...	55 6	53 6	55 0	52 0	58 0	55 0	58 0	56 0
HAMS :—								
Cumberland ...	—	—	—	—	103 6	91 0	—	—
Irish	—	—	—	—	98 6	91 6	89 0	86 0
American (long cut)	53 0	50 0	54 0	49 6	57 0	53 0	56 0	—
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	15 0	13 4	—	—	15 5	14 2	—	—
Irish	13 11	13 4	14 2	13 7	14 5	13 2	14 2	13 4
Danish ...	—	—	—	—	14 10	13 7	15 0	14 3
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton	per ton.	per ton.	per ton.
Edward VII.	92 0	82 0	70 0	65 0	81 0	71 0	—	—
Langworthy ...	89 6	84 0	85 0	80 0	99 0	89 0	70 0	65 0
Up-to-Date ...	88 6	77 6	66 6	63 6	82 0	72 6	60 0	55 0
HAY :—								
Clover ...	115 0	105 0	120 0	99 6	122 0	100 0	92 0	86 0
Meadow ...	110 0	100 0	—	—	116 6	94 6	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	FEBRUARY.		TWO MONTHS ENDED FEBRUARY.	
	1912.	1911.	1912.	1911.
Anthrax:—				
Outbreaks	114	93	206	178
Animals attacked	127	106	228	202
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	10	21	23	39
Animals attacked	12	92	45	155
Parasitic Mange:—				
Outbreaks	469	—	1,088	—
Animals attacked	960	—	2,703	—
Sheep-Scab:—				
Outbreaks	50	111	113	234
Swine-Fever:—				
Outbreaks	254	132	483	273
Swine Slaughtered as diseased or exposed to infection	3,771	1,547	6,311	3,070

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	FEBRUARY.		TWO MONTHS ENDED FEBRUARY.	
	1912.	1911.	1912.	1911.
Anthrax:—				
Outbreaks	1	2	1	3
Animals attacked	1	2	1	3
Glanders (including Farcy):—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange:—				
Outbreaks	12	13	20	21
Sheep-Scab:—				
Outbreaks	72	63	158	159
Swine-Fever:—				
Outbreaks	10	6	21	23
Swine Slaughtered as diseased or exposed to infection	46	178	192	459

SELECTED CONTENTS OF PERIODICALS.

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Aeration of the Soil by Earthworms, *J. Newton Friend.* [59.5; 63.11.] Weeds—Their Peculiarities and Distribution, *Winifred Brenchley.* [63.259(04).] (Sci. Prog., No. 23, January, 1912.)

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Toxic excreta of plants, *F. Fletcher.* [58.11.] Carbohydrates of the mangold leaf, *A. V. Campbell.* [543.1; 63.332.] The amounts of nitrogen as ammonia and nitric (and nitrous) acid in the rainwater collected at Uithuizermeeden, Groningen, *J. Hudig.* [63.113.] A note on onion couch, *L. M. Underwood.* [63.259.] The direct assimilation of inorganic and organic forms of nitrogen by higher plants, *H. B. Hutchinson* and *N. H. J. Miller.* [58.11; 63.161.] The flow of water and air through soils, *J. W. Leather.* [63.11.] The phosphate nutrition of plants, *A. Baguley.* [58.11; 63.1672.] (Jour. Agr. Sci., Vol. IV., Part 3, January, 1912.)

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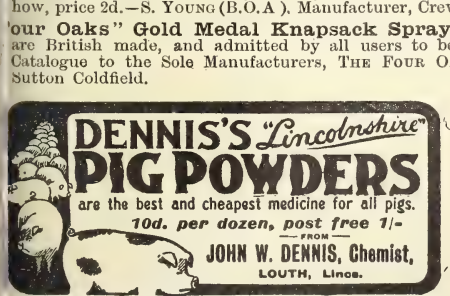

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